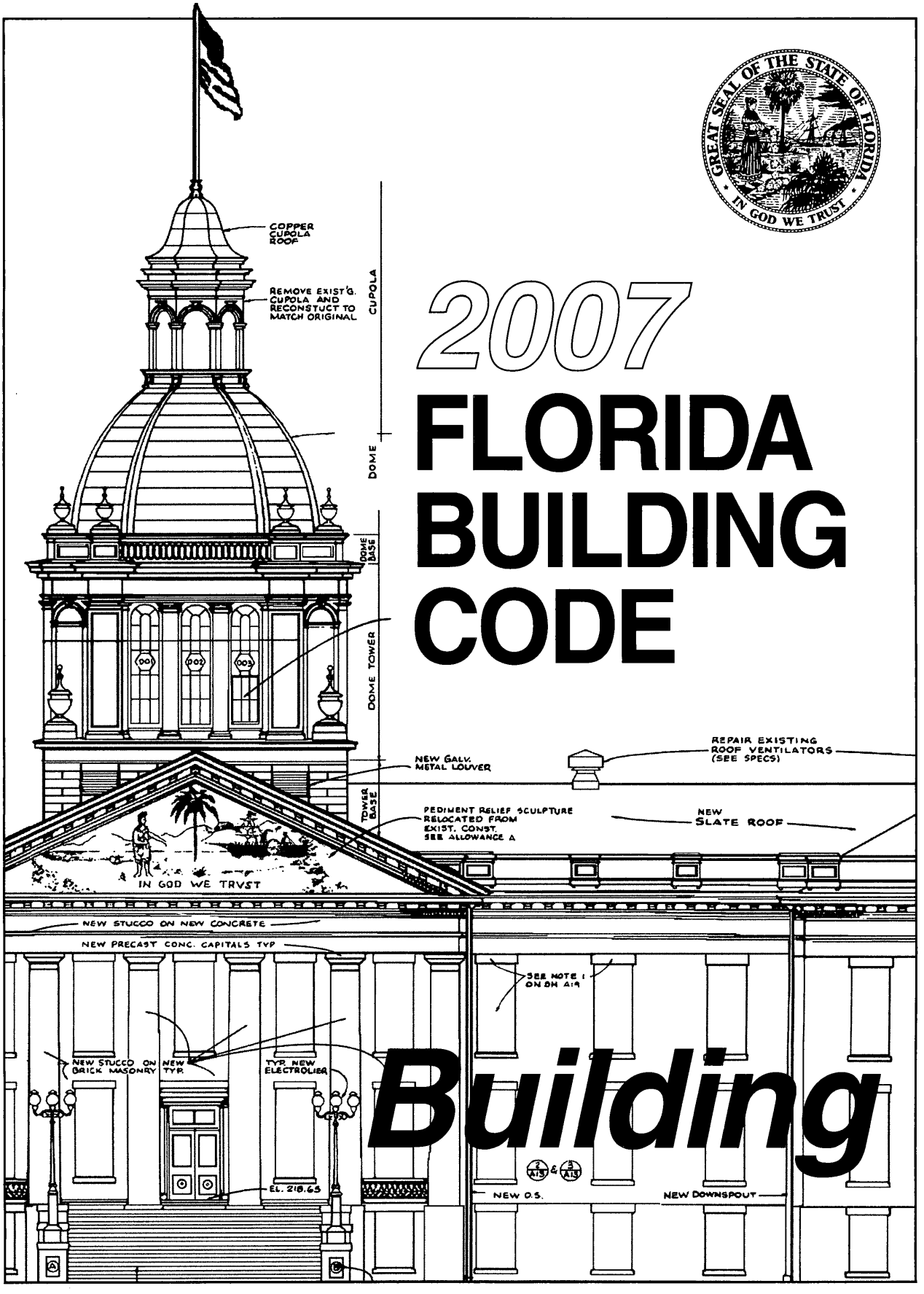

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Building

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PREFACE

History

The State of Florida first mandated statewide building codes during the 1970s at the beginning of the modern construction boom. The first law required all municipalities and counties to adopt and enforce one of the four state-recognized model codes known as the "state minimum building codes." During the early 1990s a series of natural disasters, together with the increasing complexity of building construction regulation in vastly changed markets, led to a comprehensive review of the state building code system. The study revealed that building code adoption and enforcement was inconsistent throughout the state and those local codes thought to be the strongest proved inadequate when tested by major hurricane events. The consequences of the building codes system failure were devastation to lives and economies and a statewide property insurance crisis. The response was a reform of the state building construction regulatory system that placed emphasis on uniformity and accountability.

The 1998 Florida Legislature amended Chapter 553, *Florida Statutes* (FS), Building Construction Standards, to create a single state building code that is enforced by local governments. As of March 1, 2002, the *Florida Building Code*, which is developed and maintained by the Florida Building Commission, supersedes all local building codes. The Florida Building Code is updated every three years and may be amended annually to incorporate interpretations and clarifications.

Scope

The *Florida Building Code* is based on national model building codes and national consensus standards which are amended where necessary for Florida's specific needs. The code incorporates all building construction-related regulations for public and private buildings in the State of Florida other than those specifically exempted by Section 553.73, Florida Statutes. It has been harmonized with the *Florida Fire Prevention Code*, which is developed and maintained by the Department of Financial Services, Office of the State Fire Marshal, to establish unified and consistent standards.

The base codes for the 2007 edition of the *Florida Building Code* include: the *International Building Code®*, 2006 edition; the *International Plumbing Code®*, 2006 edition; the *International Mechanical Code®*, 2006 edition; the *International Fuel Gas Code®*, 2006 edition; the *International Residential Code®*, 2006 edition; the *International Existing Building Code®*, 2006 edition; the *National Electrical Code*, 2005 edition; the U. S. Department of Housing and Urban Development, *Fair Housing Guidelines*, and; substantive criteria from the American Society of Heating, Refrigerating and Air-conditioning Engineers' (ASHRAE) Standard 90.1-2004. State and local codes adopted and incorporated into the code include the *Florida Energy Efficiency Code for Building Construction*, the *Florida Accessibility Code for Building Construction* and special hurricane protection standards for the high-velocity hurricane zone.

The code is composed of seven main volumes: the *Florida Building Code, Building,* which also includes Chapter 13 (energy efficiency) and Chapter 11(accessibility) as well as state regulations for licensed facilities; the *Florida Building Code, Plumbing*; the *Florida Building Code, Mechanical*; the *Florida Building Code, Fuel Gas*; the *Florida Existing Building Code*; the *Florida Building Code, Residential ;* and the *Florida Building Code, Test Protocols for High-Velocity Hurricane Zones.* Chapter 27 of the *Florida Building Code, Building*, adopts the *National Electrical Code*, NFPA 70, by reference. Chapter 33 of the *Florida Building Code, Residential* adopts the *National Electrical Code Requirements for One- and Two-Family Dwellings*, NFPA 70A, by reference.

Under certain strictly defined conditions, local governments may amend requirements to be more stringent than the code. All local amendments to the *Florida Building Code* must be adopted by local ordinance and reported to the Florida Building Commission then posted on www.floridabuilding.org in Legislative format for a month before being enforced. Local amendments to the *Florida Building Code* and the *Florida Fire Prevention Code* may be obtained from the Florida Building Commission web site, or from the Florida Department of Community Affairs or the Florida Department of Financial Services, Office of the State Fire Marshal, respectively.

Adoption and Maintenance

The *Florida Building Code* is adopted and updated with new editions triennially by the Florida Building Commission. It is amended annually to incorporate interpretations, clarifications and to update standards. Minimum requirements for permitting, plans review and inspections are established by the code, and local jurisdictions may adopt additional administrative requirements that are more stringent. Local technical amendments are subject to strict criteria established by Section 553.73, F.S. They are subject to commission review and adoption into the code or repeal when the code is updated triennially and are subject to appeal to the Commission according to the procedures established by Section 553.73, F.S.

Ten Technical Advisory Committees (TACs), which are constituted consistent with American National Standards Institute (ANSI) Guidelines, review proposed code changes and clarifications of the code and make recommendations to the Commission. These TACs whose membership is constituted consistent with American National Standards Institute (ANSI) Guidelines include: Accessibility; Joint Building Fire (a joint committee of the Commission and the State Fire Marshal); Building Structural; Code Ad-

ministration/ Enforcement; Electrical; Energy; Mechanical; Plumbing and Fuel Gas; Roofing; and Special Occupancy (state agency construction and facility licensing regulations).

The Commission may only issue official code clarifications using procedures of Chapter 120, Florida Statutes. To obtain such a clarification, a request for a Declaratory Statement (DEC) must be made to the Florida Building Commission in a manner that establishes a clear set of facts and circumstances and identifies the section of the code in question. Requests are analyzed by staff, reviewed by the appropriate Technical Advisory Committee, and sent to the Florida Building Commission for a first action. Draft Declaratory Statements are subject to public comment and are finalized by the Commission at its next meeting. These interpretations establish precedents for situations having similar facts and circumstances and are typically incorporated into the code in the next code amendment cycle. Non-binding opinions are available from the Building Officials Association of Florida's web site (www.BOAF.net) and a Binding Opinion process is available online at www.floridabuilding.org.

Marginal Markings

Vertical lines in the margins within the body of the code indicate a change from the requirements of the base codes to the 2007 *Florida Building Code* effective October 1, 2008.

Sections deleted from the base code are designated "Reserved."

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The *Florida Building Code* is produced through the efforts and contributions of building designers, contractors, product manufacturers, regulators and other interested parties who participate in the Florida Building Commission's consensus processes, Commission staff and the participants in the national model code development processes.

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CHAPTER 1
ADMINISTRATION

SECTION 101
GENERAL

101.1 Title. These regulations shall be known as the *Florida Building Code* hereinafter referred to as "this code."

101.2 Scope. The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

Exceptions:

1. Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the *Florida Building Code, Residential.*

2. Existing buildings undergoing repair, alterations or additions and change of occupancy shall comply with Chapter 34 of this code.

101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted.

101.3 Intent. The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.

101.4 Referenced codes. The other codes listed in Sections 101.4.1 through 101.4.9 and referenced elsewhere in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference.

101.4.1 Electrical. The provisions of Chapter 27 of the *Florida Building Code, Building* shall apply to the installation of electrical systems, including alterations, repairs, replacement, equipment, appliances, fixtures, fittings and appurtenances thereto.

101.4.2 Gas. The provisions of the *Florida Building Code, Fuel Gas* shall apply to the installation of gas piping from the point of delivery, gas appliances and related accessories as covered in this code. These requirements apply to gas piping systems extending from the point of delivery to the inlet connections of appliances and the installation and operation of residential and commercial gas appliances and related accessories.

101.4.3 Mechanical. The provisions of the *Florida Building Code, Mechanical* shall apply to the installation, alterations, repairs and replacement of mechanical systems, including equipment, appliances, fixtures, fittings and/or appurtenances, including ventilating, heating, cooling, air-conditioning and refrigeration systems, incinerators and other energy-related systems.

101.4.4 Plumbing. The provisions of the *Florida Building Code, Plumbing* shall apply to the installation, alteration, repair and replacement of plumbing systems, including equipment, appliances, fixtures, fittings and appurtenances, and where connected to a water or sewage system and all aspects of a medical gas system.

101.4.5 Property maintenance. Reserved.

101.4.6 Fire prevention. For provisions related to fire prevention, refer to the *Florida Fire Prevention Code. The Florida Fire Prevention Code* shall apply to matters affecting or relating to structures, processes and premises from the hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices; from conditions hazardous to life, property or public welfare in the occupancy of structures or premises; and from the construction, extension, repair, alteration or removal of fire suppression and alarm systems or fire hazards in the structure or on the premises from occupancy or operation.

101.4.7 Energy. The provisions of Chapter 13 of the *Florida Building Code, Building* shall apply to all matters governing the design and construction of buildings for energy efficiency.

101.4.8 Accessibility. For provisions related to accessibility, refer to Chapter 11 of the *Florida Building Code, Building.*

101.4.9 Manufactured buildings. For additional administrative and special code requirements, see section 428, *Florida Building Code, Building*, and Rule 9B-1 F.A.C.

SECTION 102
APPLICABILITY

102.1 General. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.

102.1.1 The *Florida Building Code* does not apply to, and no code enforcement action shall be brought with respect to, zoning requirements, land use requirements and owner specifications or programmatic requirements which do not pertain to and govern the design, construction, erection, alteration, modification, repair or demolition of public or private buildings, structures or facilities or to programmatic requirements that do not pertain to enforcement of the *Florida Building Code.* Additionally, a local code enforcement agency may not administer or enforce the *Florida Building Code, Building* to prevent the siting of any publicly owned facility, including, but not limited to, correc-

tional facilities, juvenile justice facilities, or state universities, community colleges, or public education facilities, as provided by law.

102.2 Building. The provisions of the *Florida Building Code* shall apply to the construction, erection, alteration, modification, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every public and private building, structure or facility or floating residential structure, or any appurtenances connected or attached to such buildings, structures or facilities. Additions, alterations, repairs and changes of use or occupancy group in all buildings and structures shall comply with the provisions provided in Chapter 34 of this code. The following buildings, structures and facilities are exempt from the *Florida Building Code* as provided by law, and any further exemptions shall be as determined by the legislature and provided by law:

(a) Building and structures specifically regulated and preempted by the federal government.

(b) Railroads and ancillary facilities associated with the railroad.

(c) Nonresidential farm buildings on farms.

(d) Temporary buildings or sheds used exclusively for construction purposes.

(e) Mobile or modular structures used as temporary offices, except that the provisions of Part V (Section 553.501-553.513, *Florida Statutes*) relating to accessibility by persons with disabilities shall apply to such mobile or modular structures.

(f) Those structures or facilities of electric utilities, as defined in Section 366.02, *Florida Statutes*, which are directly involved in the generation, transmission or distribution of electricity.

(g) Temporary sets, assemblies or structures used in commercial motion picture or television production, or any sound-recording equipment used in such production, on or off the premises.

(h) Chickees constructed by the Miccosukee Tribe of Indians of Florida or the Seminole Tribe of Florida. As used in this paragraph, the term "chickee" means an open-sided wooden hut that has a thatched roof of palm or palmetto or other traditional materials, and that does not incorporate any electrical, plumbing or other nonwood features.

102.2.1 In addition to the requirements of Section 553.79 and 553.80, *Florida Statutes*, facilities subject to the provisions of Chapter 395, *Florida Statutes*, and Part II of Chapter 400, *Florida Statutes*, shall have facility plans reviewed and construction surveyed by the state agency authorized to do so under the requirements of Chapter 395, *Florida Statutes*, and Part II of Chapter 400, *Florida Statutes*, and the certification requirements of the federal government.

102.2.2 Residential buildings or structures moved into or within a county or municipality shall not be required to be brought into compliance with the state minimum building code in force at the time the building or structure is moved, provided:

1. The building or structure is structurally sound and in occupiable condition for its intended use;
2. The occupancy use classification for the building or structure is not changed as a result of the move;
3. The building is not substantially remodeled;
4. Current fire code requirements for ingress and egress are met;
5. Electrical, gas and plumbing systems meet the codes in force at the time of construction and are operational and safe for reconnection; and
6. Foundation plans are sealed by a professional engineer or architect licensed to practice in this state, if required by the *Florida Building Code, Building* for all residential buildings or structures of the same occupancy class.

102.2.3 The building official shall apply the same standard to a moved residential building or structure as that applied to the remodeling of any comparable residential building or structure to determine whether the moved structure is substantially remodeled.

The cost of the foundation on which the moved building or structure is placed shall not be included in the cost of remodeling for purposes of determining whether a moved building or structure has been substantially remodeled.

102.2.4 This section does not apply to the jurisdiction and authority of the Department of Agriculture and Consumer Services to inspect amusement rides or the Department of Financial Services to inspect state-owned buildings and boilers.

102.2.5 Each enforcement district shall be governed by a board, the composition of which shall be determined by the affected localities. At its own option, each enforcement district or local enforcement agency may promulgate rules granting to the owner of a single-family residence one or more exemptions from the *Florida Building Code* relating to:

1. Addition, alteration or repair performed by the property owner upon his or her own property, provided any addition or alteration shall not exceed 1,000 square feet (93 m^2) or the square footage of the primary structure, whichever is less.
2. Addition, alteration or repairs by a nonowner within a specific cost limitation set by rule, provided the total cost shall not exceed $5,000 within any 12-month period.
3. Building and inspection fees.

Each code exemption, as defined in this section, shall be certified to the local board 10 days prior to implementation and shall be effective only in the territorial jurisdiction of the enforcement district or local enforcement agency implementing it.

102.2.6 This section does not apply to swings and other playground equipment accessory to a one- or two-family dwelling.

Exception: Electrical service to such playground equipment shall be in accordance with Chapter 27 of this code.

102.3 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

102.4 Referenced codes and standards. The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference. Where differences occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

102.5 Partial invalidity. Reserved.

102.6 Existing structures. The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, or the *Florida Fire Prevention Code*, or as is deemed necessary by the building official for the general safety and welfare of the occupants and the public.

102.7 Relocation of manufactured buildings.

1. Relocation of an existing manufactured building does not constitute an alteration.
2. A relocated building shall comply with wind speed requirements of the new location, using the appropriate wind speed map. If the existing building was manufactured in compliance with the *Standard Building Code* (prior to March 1, 2002), the wind speed map of the *Standard Building Code* shall be applicable. If the existing building was manufactured in compliance with the *Florida Building Code* (after March 1, 2002), the wind speed map of the *Florida Building Code* shall be applicable.

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DEPARTMENT OF BUILDING SAFETY
RESERVED

SECTION 104
DUTIES AND POWERS OF THE BUILDING OFFICIAL

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104.2 Applications and permits. Reserved.

104.3 Notices and orders. Reserved.

104.4 Inspections. Reserved.

104.5 Identification. Reserved.

104.6 Right of entry. Reserved.

104.7 Department records. Reserved.

104.8 Liability. Reserved.

104.9 Approved materials and equipment. Materials, equipment and devices approved by the building official shall be constructed and installed in accordance with such approval.

104.9.1 Used materials and equipment. The use of used materials which meet the requirements of this code for new materials is permitted. Used equipment and devices shall not be reused unless approved by the building official.

104.10 Modifications. Reserved.

104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. When alternate life safety systems are designed, the SFPE *Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings*, or other methods approved by the building official may be used. The building official shall require that sufficient evidence or proof be submitted to substantiate any claim made regarding the alternative.

104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

104.11.3 Accessibility. Alternative designs and technologies for providing access to and usability of a facility for persons with disabilities shall be in accordance with Section 11-2.2.

SECTION 105
PERMITS

105.1 Required. Any owner or authorized agent who intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any required impact-resistant coverings, electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be done, shall first make

application to the building official and obtain the required permit.

105.1.1 Annual facility permit. In lieu of an individual permit for each alteration to an existing electrical, gas, mechanical, plumbing or interior nonstructural office system(s), the building official is authorized to issue an annual permit for any occupancy to facilitate routine or emergency service, repair, refurbishing, minor renovations of service systems or manufacturing equipment installations/relocations. The building official shall be notified of major changes and shall retain the right to make inspections at the facility site as deemed necessary. An annual facility permit shall be assessed with an annual fee and shall be valid for one year from date of issuance. A separate permit shall be obtained for each facility and for each construction trade, as applicable. The permit application shall contain a general description of the parameters of work intended to be performed during the year.

105.1.2 Annual permit records. The person to whom an annual permit is issued shall keep a detailed record of alterations made under such annual permit. The building official shall have access to such records at all times or such records shall be filed with the building official as designated.

105.1.3 Food permit. As per Section 500.12, *Florida Statutes*, a food permit from the Department of Agriculture and Consumer Services is required of any person who operates a food establishment or retail store.

105.2 Work exempt from permit. Exemptions from permit requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code. Permits shall not be required for the following:

Gas:

1. Portable heating appliance.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

Mechanical:

1. Portable heating appliance.
2. Portable ventilation equipment.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any part which does not alter its approval or make it unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration system containing 10 pounds (4.54 kg) or less of refrigerant and actuated by motors of 1 horsepower (746 W) or less.
8. The installation, replacement, removal or metering of any load management control device.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe provided, however, that if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a permit shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

105.2.1 Emergency repairs. Where equipment replacements and repairs must be performed in an emergency situation, the permit application shall be submitted within the next working business day to the building official.

105.2.2 Minor repairs. Ordinary minor repairs may be made with the approval of the building official without a permit, provided the repairs do not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or load-bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; additionally, ordinary minor repairs shall not include addition to, alteration of, replacement or relocation of any standpipe, water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring systems or mechanical equipment or other work affecting public health or general safety, and such repairs shall not violate any of the provisions of the technical codes.

105.2.3 Public service agencies. Reserved.

105.3 Application for permit. To obtain a permit, the applicant shall first file an application therefor in writing on a form furnished by the building department for that purpose. Permit application forms shall be in the format prescribed by a local administrative board, if applicable, and must comply with the requirements of Section 713.135(5) and (6), *Florida Statutes*.

Each application shall be inscribed with the date of application, and the code in effect as of that date. For a building permit for which an application is submitted prior to the effective date of the *Florida Building Code*, the state minimum building code in effect in the permitting jurisdiction on the date of the application governs the permitted work for the life of the permit and any extension granted to the permit.

105.3.1 Action on application. The building official shall examine or cause to be examined applications for permits and amendments thereto within a reasonable time after filing. If the application or the construction documents do not conform to the requirements of pertinent laws, the building official shall reject such application in writing, stating the reasons therefor. If the building official is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the building official shall issue a permit therefor as soon as practicable. When authorized through contractual agreement with a school board, in acting on applications for permits, the building official shall give first priority to any applications for the construction of, or addition or renovation to, any school or educational facility.

105.3.1.1 If a state university, state community college or public school district elects to use a local government's code enforcement offices, fees charged by counties and municipalities for enforcement of the *Florida Building Code* on buildings, structures, and facilities of state universities, state colleges and public school districts shall not be more than the actual labor and administrative costs incurred for plans review and inspections to ensure compliance with the code.

105.3.1.2 No permit may be issued for any building construction, erection, alteration, modification, repair or addition unless the applicant for such permit provides to the enforcing agency which issues the permit any of the following documents which apply to the construction for which the permit is to be issued and which shall be prepared by or under the direction of an engineer registered under Chapter 471, *Florida Statutes*:

1. Plumbing documents for any new building or addition which requires a plumbing system with more than 250 fixture units or which costs more than $50,000.
2. Fire sprinkler documents for any new building or addition which includes a fire sprinkler system which contains 50 or more sprinkler heads. A Contractor I, Contractor II or Contractor IV, certified under Section 633.521, *Florida Statutes*, may design a fire sprinkler system of 49 or fewer heads and may design the alteration of an existing fire sprinkler system if the alteration consists of the relocation, addition or deletion of not more than 49 heads, notwithstanding the size of the existing fire sprinkler system.
3. Heating, ventilation and air-conditioning documents for any new building or addition which requires more than a 15-ton-per-system capacity which is designed to accommodate 100 or more persons or for which the system costs more than $50,000. This paragraph does not include any document for the replacement or repair of an existing system in which the work does not require altering a structural part of the building or for work on a residential one-, two-, three or four-family structure.

An air-conditioning system may be designed by an installing air-conditioning contractor certified under Chapter 489, *Florida Statutes*, to serve any building or addition which is designed to accommodate fewer than 100 persons and requires an air-conditioning system with a value of $50,000 or less; and when a 15-ton-per system or less is designed for a singular space of a building and each 15-ton system or less has an independent duct system. Systems not complying with the above require design documents that are to be sealed by a professional engineer.

Example 1: When a space has two 10-ton systems with each having an independent duct system, the contractor may design these two systems since each unit (system) is less than 15 tons.

Example 2: Consider a small single-story office building which consists of six individual offices where each office has a single 3-ton package air conditioning heat pump. The six heat pumps are connected to a single water cooling tower. The cost of the entire heating, ventilation and air-conditioning work is $47,000 and the office building accommodates fewer than 100 persons. Because the six mechanical units are connected to a common water tower this is considered to be an 18-ton system. It therefore could not be designed by a mechanical or air conditioning contractor.

NOTE: It was further clarified by the Commission that the limiting criteria of 100 persons and $50,000 apply to the building occupancy load and the cost for the total air-conditioning system of the building.

4. Any specialized mechanical, electrical, or plumbing document for any new building or addition which includes a medical gas, oxygen, steam, vacuum, toxic air filtration, halon, or fire detection and alarm system which costs more than $5,000.

Documents requiring an engineer seal by this part shall not be valid unless a professional engineer who possesses a valid certificate of registration has signed, dated, and stamped such document as provided in Section 471.025, *Florida Statutes*.

105.3.2 Time limitation of application. An application for a permit for any proposed work shall be deemed to have been abandoned 180 days after the date of filing, unless such application has been pursued in good faith or a permit has been issued; except that the building official is authorized to grant one or more extensions of time for additional periods not exceeding 90 days each. The extension shall be requested in writing and justifiable cause demonstrated.

105.3.3 An enforcing authority may not issue a building permit for any building construction, erection, alteration, modification, repair or addition unless the permit either includes on its face or there is attached to the permit the following statement: "NOTICE: In addition to the requirements of this permit, there may be additional restrictions applicable to this property that may be found in the public records of this county, and there may be additional permits required from other governmental entities such as water management districts, state agencies or federal agencies."

105.3.4 A building permit for a single-family residential dwelling must be issued within 30 working days of application therefor unless unusual circumstances require a longer time for processing the application or unless the permit application fails to satisfy the *Florida Building Code* or the enforcing agency's laws or ordinances.

105.3.5 Identification of minimum premium policy. Except as otherwise provided in Chapter 440, *Florida Statutes*, Workers' Compensation, every employer shall, as a condition to receiving a building permit, show proof that it has secured compensation for its employees as provided in Section 440.10 and 440.38, *Florida Statutes*.

105.3.6 Asbestos removal. Moving, removal or disposal of asbestos-containing materials on a residential building where the owner occupies the building, the building is not for sale or lease, and the work is performed according to the

owner-builder limitations provided in this paragraph. To qualify for exemption under this paragraph, an owner must personally appear and sign the building permit application. The permitting agency shall provide the person with a disclosure statement in substantially the following form:

Disclosure Statement: State law requires asbestos abatement to be done by licensed contractors. You have applied for a permit under an exemption to that law. The exemption allows you, as the owner of your property, to act as your own asbestos abatement contractor even though you do not have a license. You must supervise the construction yourself. You may move, remove or dispose of asbestos-containing materials on a residential building where you occupy the building and the building is not for sale or lease, or the building is a farm outbuilding on your property. If you sell or lease such building within 1 year after the asbestos abatement is complete, the law will presume that you intended to sell or lease the property at the time the work was done, which is a violation of this exemption. You may not hire an unlicensed person as your contractor. Your work must be done according to all local, state and federal laws and regulations which apply to asbestos abatement projects. It is your responsibility to make sure that people employed by you have licenses required by state law and by county or municipal licensing ordinances.

105.4 Conditions of the permit.

105.4.1 Permit intent. A permit issued shall be construed to be a license to proceed with the work and not as authority to violate, cancel, alter or set aside any of the provisions of the technical codes, nor shall issuance of a permit prevent the building official from thereafter requiring a correction of errors in plans, construction or violations of this code. Every permit issued shall become invalid unless the work authorized by such permit is commenced within 6 months after its issuance, or if the work authorized by such permit is suspended or abandoned for a period of 6 months after the time the work is commenced.

105.4.1.1 If work has commenced and the permit is revoked, becomes null and void or expires because of lack of progress or abandonment, a new permit covering the proposed construction shall be obtained before proceeding with the work.

105.4.1.2 If a new permit is not obtained within 180 days from the date the initial permit became null and void, the building official is authorized to require that any work which has been commenced or completed be removed from the building site. Alternately, a new permit may be issued on application, providing the work in place and required to complete the structure meets all applicable regulations in effect at the time the initial permit became null and void and any regulations which may have become effective between the date of expiration and the date of issuance of the new permit.

105.4.1.3 Work shall be considered to be in active progress when the permit has received an approved inspection within 180 days. This provision shall not be applicable in case of civil commotion or strike or when the building work is halted due directly to judicial injunction, order or similar process.

105.4.1.4 The fee for renewal reissuance and extension of a permit shall be set forth by the administrative authority.

105.5 Expiration. Reserved.

105.6 Suspension or revocation. Reserved.

105.7 Placement of permit. The building permit or copy shall be kept on the site of the work until the completion of the project.

105.8 Notice of commencement. As per Section 713.135, *Florida Statutes*, when any person applies for a building permit, the authority issuing such permit shall print on the face of each permit card in no less than 18-point, capitalized, boldfaced type: "WARNING TO OWNER: YOUR FAILURE TO RECORD A NOTICE OF COMMENCEMENT MAY RESULT IN YOUR PAYING TWICE FOR IMPROVEMENTS TO YOUR PROPERTY. IF YOU INTEND TO OBTAIN FINANCING, CONSULT WITH YOUR LENDER OR AN ATTORNEY BEFORE RECORDING YOUR NOTICE OF COMMENCEMENT."

105.9 Asbestos. The enforcing agency shall require each building permit for the demolition or renovation of an existing structure to contain an asbestos notification statement which indicates the owner's or operator's responsibility to comply with the provisions of Section 469.003, *Florida Statutes*, and to notify the Department of Environmental Protection of his or her intentions to remove asbestos, when applicable, in accordance with state and federal law.

105.10 Certificate of protective treatment for prevention of termites. A weather-resistant job-site posting board shall be provided to receive duplicate treatment certificates as each required protective treatment is completed, providing a copy for the person the permit is issued to and another copy for the building permit files. The treatment certificate shall provide the product used, identity of the applicator, time and date of the treatment, site location, area treated, chemical used, percent concentration and number of gallons used, to establish a verifiable record of protective treatment. If the soil chemical barrier method for termite prevention is used, final exterior treatment shall be completed prior to final building approval.

105.11 Notice of termite protection. A permanent sign which identifies the termite treatment provider and need for reinspection and treatment contract renewal shall be provided. The sign shall be posted near the water heater or electric panel.

105.12 Work starting before permit issuance. Upon approval of the building official, the scope of work delineated in the building permit application and plan may be started prior to the final approval and issuance of the permit, provided any

work completed is entirely at risk of the permit applicant and the work does not proceed past the first required inspection.

105.13 Phased permit approval. After submittal of the appropriate construction documents, the building official is authorized to issue a permit for the construction of foundations or any other part of a building or structure before the construction documents for the whole building or structure have been submitted. The holder of such permit for the foundation or other parts of a building or structure shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire structure will be granted. Corrections may be required to meet the requirements of the technical codes.

105.14 Permit issued on basis of an affidavit. Whenever a permit is issued in reliance upon an affidavit or whenever the work to be covered by a permit involves installation under conditions which, in the opinion of the building official, are hazardous or complex, the building official shall require that the architect or engineer who signed the affidavit or prepared the drawings or computations shall supervise such work. In addition, they shall be responsible for conformity to the permit, provide copies of inspection reports as inspections are performed, and upon completion make and file with the building official written affidavit that the work has been done in conformity to the reviewed plans and with the structural provisions of the technical codes. In the event such architect or engineer is not available, the owner shall employ in his stead a competent person or agency whose qualifications are reviewed by the building official. The building official shall ensure that any person conducting plans review is qualified as a plans examiner under Part XII of Chapter 468, *Florida Statutes*, and that any person conducting inspections is qualified as a building inspector under Part III of Chapter 468, *Florida Statutes*.

SECTION 106
CONSTRUCTION DOCUMENTS

106.1 Submittal documents. Construction documents, a statement of special inspections and other data shall be submitted in one or more sets with each application for a permit. The construction documents shall be prepared by a design professional where required by the statutes. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a design professional.

Exception: The building official is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.

If the design professional is an architect or engineer legally registered under the laws of this state regulating the practice of architecture as provided for in Chapter 481, *Florida Statutes*, Part I, or engineering as provided for in Chapter 471, *Florida Statutes*, then he or she shall affix his or her official seal to said drawings, specifications and accompanying data, as required by *Florida Statute*. If the design professional is a landscape architect registered under the laws of this state regulating the practice of landscape architecture as provided for in Chapter 481, *Florida Statutes*, Part II, then he or she shall affix his or her seal to said drawings, specifications and accompanying data as defined in Section 481.303(6)(a)(b)(c)(d), *FS*.

106.1.1 Information on construction documents. Construction documents shall be dimensioned and drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official (see also Section 106.3.5).

106.1.1.1 Fire protection system shop drawings. Shop drawings for the fire protection system(s) shall be submitted to indicate conformance with this code and the construction documents and shall be approved prior to the start of system installation. Shop drawings shall contain all information as required by the referenced installation standards in Chapter 9.

106.1.1.2 For roof assemblies required by the code, the construction documents shall illustrate, describe and delineate the type of roofing system, materials, fastening requirements, flashing requirements and wind resistance rating that are required to be installed. Product evaluation and installation shall indicate compliance with the wind criteria required for the specific site or a statement by an architect or engineer for the specific site must be submitted with the construction documents.

106.1.2 Means of egress. Reserved.

106.1.3 Exterior wall envelope. Reserved.

106.2 Site plan. Reserved.

106.3 Examination of documents. The building official shall examine or cause to be examined the accompanying construction documents and shall ascertain by such examinations whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.

Exceptions:

1. Building plans approved pursuant to Section 553.77(5), *Florida Statutes*, and state-approved manufactured buildings are exempt from local codes enforcing agency plan reviews except for provisions of the code relating to erection, assembly or construction at the site. Erection, assembly and construction at the site are subject to local permitting and inspections.
2. Industrial construction on sites where design, construction and fire safety are supervised by appropriate design and inspection professionals and which contain adequate in-house fire departments and rescue squads is exempt, subject to local government option, from review of plans and inspections, providing owners certify that applicable codes and standards have been met and supply appropriate approved drawings to local building and fire-safety inspectors.

106.3.1 Approval of construction documents. When the building official issues a permit, the construction documents shall be approved, in writing or by stamp, as "Reviewed for Code Compliance." One set of construction documents so reviewed shall be retained by the building official. The other set shall be returned to the applicant, shall be kept at the site of work and shall be open to inspection by the building official or a duly authorized representative.

106.3.2 Previous approvals. This code shall not require changes in the construction documents, construction or designated occupancy of a structure for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.

106.3.3 Phased approval. Reserved.

106.3.4 Design professional in responsible charge. Reserved.

106.3.4.1 General. Reserved.

106.3.4.2 Deferred submittals. Reserved.

106.3.4.3 Certifications by contractors authorized under the provisions of Section 489.115(4)(b), *Florida Statutes*, shall be considered equivalent to sealed plans and specifications by a person licensed under Chapter 471, *Florida Statutes*, or Chapter 481 *Florida Statutes*, by local enforcement agencies for plans review for permitting purposes relating to compliance with the wind-resistance provisions of the code or alternate methodologies approved by the Florida Building Commission for one- and two-family dwellings. Local enforcement agencies may rely upon such certification by contractors that the plans and specifications submitted conform to the requirements of the code for wind resistance. Upon good cause shown, local government code enforcement agencies may accept or reject plans sealed by persons licensed under Chapters 471, 481 or 489, *Florida Statutes*.

106.3.5 Minimum plan review criteria for buildings. The examination of the documents by the building official shall include the following minimum criteria and documents: a floor plan; site plan; foundation plan; floor/roof framing plan or truss layout; and all exterior elevations:

Commercial Buildings:

Building

1. Site requirements:
   Parking
   Fire access
   Vehicle loading
   Driving/turning radius
   Fire hydrant/water supply/post indicator valve (PIV)
   Set back/separation (assumed property lines)
   Location of specific tanks, water lines and sewer lines
2. Occupancy group and special occupancy requirements shall be determined.
3. Minimum type of construction shall be determined (see Table 503).
4. Fire-resistant construction requirements shall include the following components:
   Fire-resistant separations
   Fire-resistant protection for type of construction
   Protection of openings and penetrations of rated walls Fire blocking and draftstopping and calculated fire resistance
5. Fire suppression systems shall include:
   Early warning smoke evacuation systems Schematic fire sprinklers
   Standpipes
   Preengineered systems
   Riser diagram
   Same as above
6. Life safety systems shall be determined and shall include the following requirements:
   Occupant load and egress capacities
   Early warning
   Smoke control
   Stair pressurization
   Systems schematic
7. Occupancy load/egress requirements shall include:
   Occupancy load
   Gross
   Net
   Means of egress
   Exit access
   Exit
   Exit discharge
   Stairs construction/geometry and protection
   Doors
   Emergency lighting and exit signs
   Specific occupancy requirements
   Construction requirements
   Horizontal exits/exit passageways
8. Structural requirements shall include:
   Soil conditions/analysis
   Termite protection
   Design loads
   Wind requirements
   Building envelope
   Structural calculations (if required)
   Foundation
   Wall systems
   Floor systems
   Roof systems
   Threshold inspection plan
   Stair systems
9. Materials shall be reviewed and shall at a minimum include the following:
   Wood
   Steel
   Aluminum
   Concrete
   Plastic
   Glass

Masonry
Gypsum board and plaster
Insulating (mechanical)
Roofing
Insulation

10. Accessibility requirements shall include the following:
Site requirements
Accessible route
Vertical accessibility
Toilet and bathing facilities
Drinking fountains
Equipment
Special occupancy requirements
Fair housing requirements
11. Interior requirements shall include the following:
Interior finishes (flame spread/smoke development)
Light and ventilation
Sanitation
12. Special systems:
Elevators
Escalators
Lifts
13. Swimming pools:
Barrier requirements
Spas
Wading pools

Electrical

1. Electrical:
Wiring
Services
Feeders and branch circuits
Overcurrent protection
Grounding
Wiring methods and materials
GFCIs
2. Equipment
3. Special occupancies
4. Emergency systems
5. Communication systems
6. Low voltage
7. Load calculations

Plumbing

1. Minimum plumbing facilities
2. Fixture requirements
3. Water supply piping
4. Sanitary drainage
5. Water heaters
6. Vents
7. Roof drainage
8. Back flow prevention
9. Irrigation
10. Location of water supply line
11. Grease traps
12. Environmental requirements
13. Plumbing riser

Mechanical

1. Energy calculations
2. Exhaust systems:
Clothes dryer exhaust
Kitchen equipment exhaust
Specialty exhaust systems
3. Equipment
4. Equipment location
5. Make-up air
6. Roof-mounted equipment
7. Duct systems
8. Ventilation
9. Combustion air
10. Chimneys, fireplaces and vents
11. Appliances
12. Boilers
13. Refrigeration
14. Bathroom ventilation
15. Laboratory

Gas

1. Gas piping
2. Venting
3. Combustion air
4. Chimneys and vents
5. Appliances
6. Type of gas
7. Fireplaces
8. LP tank location
9. Riser diagram/shutoffs

Demolition

1. Asbestos removal

Residential (one- and two-family)

1. Site requirements
Set back/separation (assumed property lines)
Location of septic tanks
2. Fire-resistant construction (if required)
3. Fire
4. Smoke detector locations
5. Egress
Egress window size and location stairs construction requirements

6. Structural requirements shall include:

   Wall section from foundation through roof, including assembly and materials connector tables wind requirements structural calculations (if required)

7. Accessibility requirements: show/identify accessible bath

Exemptions.

Plans examination by the building official shall not be required for the following work:

1. Replacing existing equipment such as mechanical units, water heaters, etc.
2. Reroofs
3. Minor electrical, plumbing and mechanical repairs
4. Annual maintenance permits
5. Prototype plans

   Except for local site adaptions, siding, foundations and/or modifications.

   Except for structures that require waiver.

6. Manufactured buildings plan except for foundations and modifications of buildings on site.

106.4 Amended construction documents. Work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

106.5 Retention of construction documents. One set of approved construction documents shall be retained by the building official for a period of not less than 180 days from date of completion of the permitted work, or as required by *Florida Statutes*.

106.6 Affidavits. The building official may accept a sworn affidavit from a registered architect or engineer stating that the plans submitted conform to the technical codes. For buildings and structures, the affidavit shall state that the plans conform to the laws as to egress, type of construction and general arrangement and, if accompanied by drawings, show the structural design and that the plans and design conform to the requirements of the technical codes as to strength, stresses, strains, loads and stability. The building official may without any examination or inspection accept such affidavit, provided the architect or engineer who made such affidavit agrees to submit to the building official copies of inspection reports as inspections are performed and upon completion of the structure, electrical, gas, mechanical or plumbing systems a certification that the structure, electrical, gas, mechanical or plumbing system has been erected in accordance with the requirements of the technical codes. Where the building official relies upon such affidavit, the architect or engineer shall assume full responsibility for compliance with all provisions of the technical codes and other pertinent laws or ordinances. The building official shall ensure that any person conducting plans review is qualified as a plans examiner under Part XII of Chapter 468, *Florida Statutes*, and that any person conducting inspections is qualified as a building inspector under Part XII of Chapter 468, *Florida Statutes*.

SECTION 107
TEMPORARY STRUCTURES AND USES

107.1 General. The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause.

107.2 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

107.3 Temporary power. The building official is authorized to give permission to temporarily supply and use power in part of an electric installation before such installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in Chapter 27 of the *Florida Building Code, Building*.

107.4 Termination of approval. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

SECTION 108
FEES

108.1 Prescribed fees. A permit shall not be issued until fees authorized under Section 553.80, *Florida Statutes*, have been paid. Nor shall an amendment to a permit be released until the additional fee, if any, due to an increase in the estimated cost of the building, structure, electrical, plumbing, mechanical or gas systems has been paid.

108.2 Schedule of permit fees. On buildings, structures, electrical, gas, mechanical, and plumbing systems or alterations requiring a permit, a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

108.3 Building permit valuations. Reserved.

108.4 Work commencing before permit issuance. Any person who commences any work on a building, structure, electrical, gas, mechanical or plumbing system before obtaining the building official's approval or the necessary permits shall be subject to a penalty of 100 percent of the usual permit fee in addition to the required permit fees.

108.5 Related fees. Reserved.

108.6 Refunds. Reserved.

SECTION 109
INSPECTIONS

109.1 General. Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the building official nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.

109.2 Preliminary inspection. Before issuing a permit, the building official is authorized to examine or cause to be examined buildings, structures and sites for which an application has been filed.

109.3 Required inspections. The building official upon notification from the permit holder or his or her agent, shall make the following inspections, and shall either release that portion of the construction or shall notify the permit holder or his or her agent of any violations which must be corrected in order to comply with the technical codes. The building official shall determine the timing and sequencing of when inspections occur and what elements are inspected at each inspection.

Building

1. Foundation inspection. To be made after trenches are excavated and forms erected and shall at a minimum include the following building components:
   - Stem-wall
   - Monolithic slab-on-grade
   - Piling/pile caps
   - Footers/grade beams
2. Framing inspection. To be made after the roof, all framing, fireblocking and bracing is in place, all concealed wiring, all pipes, chimneys, ducts and vents are complete and shall at a minimum include the following building components:
   - Window/door framing
   - Vertical cells/columns
   - Lintel/tie beams
   - Framing/trusses/bracing/connectors
   - Draft stopping/fire blocking
   - Curtain wall framing
   - Energy insulation
   - Accessibility.
   - Verify rough opening dimensions are within tolerances.
3. Sheathing inspection. To be made either as part of a dry-in inspection or done separately at the request of the contractor after all roof and wall sheathing and fasteners are complete and shall at a minimum include the following building components:
   - Roof sheathing
   - Wall sheathing
   - Sheathing fasteners
   - Roof/wall dry-in.
4. Roofing inspection. Shall at a minimum include the following building components:
   - Dry-in
   - Insulation
   - Roof coverings
   - Flashing
5. Final inspection. To be made after the building is completed and ready for occupancy.
6. Swimming pool inspection. First inspection to be made after excavation and installation of reinforcing steel, bonding and main drain and prior to placing of concrete.

   Final inspection to be made when the swimming pool is complete and all required enclosure requirements are in place.

   In order to pass final inspection and receive a certificate of completion, a residential swimming pool must meet the requirements relating to pool safety features as described in Section 424.2.17.
7. Demolition inspections. First inspection to be made after all utility connections have been disconnected and secured in such manner that no unsafe or unsanitary conditions shall exist during or after demolition operations.

   Final inspection to be made after all demolition work is completed.
8. Manufactured building inspections. The building department shall inspect construction of foundations; connecting buildings to foundations; installation of parts identified on plans as site installed items, joining the modules, including utility crossovers; utility connections from the building to utility lines on site; and any other work done on site which requires compliance with the *Florida Building Code*. Additional inspections may be required for public educational facilities (see Section 423.27.20).
9. Where impact-resistant coverings are installed to meet requirements of this code, the building official shall schedule adequate inspections of impact-resistant coverings to determine the following:

   The system indicated on the plans was installed.

   The system is installed in accordance with the manufacturer's installation instructions and the product approval.

Electrical

1. Underground inspection. To be made after trenches or ditches are excavated, conduit or cable is installed, and before any backfill is put in place.
2. Rough-in inspection. To be made after the roof, framing, fireblocking and bracing is in place and prior to the installation of wall or ceiling membranes.
3. Final inspection. To be made after the building is complete, all required electrical fixtures are in place and properly connected or protected, and the structure is ready for occupancy.

Plumbing

1. Underground inspection. To be made after trenches or ditches are excavated, piping is installed, and before any backfill is put in place.
2. Rough-in inspection. To be made after the roof, framing, fireblocking and bracing is in place and all soil, waste and vent piping is complete, and prior to this installation of wall or ceiling membranes.
3. Final inspection. To be made after the building is complete, all plumbing fixtures are in place and properly connected, and the structure is ready for occupancy.

   Note: See Section 312 of the *Florida Building Code, Plumbing* for required tests.

Mechanical

1. Underground inspection. To be made after trenches or ditches are excavated, underground duct and fuel piping is installed, and before any backfill is put in place.
2. Rough-in inspection. To be made after the roof, framing, fire blocking and bracing are in place and all ducting, and other concealed components are complete, and prior to the installation of wall or ceiling membranes.
3. Final inspection. To be made after the building is complete, the mechanical system is in place and properly connected, and the structure is ready for occupancy.

Gas

1. Rough piping inspection. To be made after all new piping authorized by the permit has been installed, and before any such piping has been covered or concealed or any fixtures or gas appliances have been connected.
2. Final piping inspection. To be made after all piping authorized by the permit has been installed and after all portions which are to be concealed by plastering or otherwise have been so concealed, and before any fixtures or gas appliances have been connected. This inspection shall include a pressure test.
3. Final inspection. To be made on all new gas work authorized by the permit and such portions of existing systems as may be affected by new work or any changes, to ensure compliance with all the requirements of this code and to assure that the installation and construction of the gas system is in accordance with reviewed plans.

109.3.1 Footing and foundation inspection. Reserved.

109.3.2 Concrete slab and under-floor inspection. Reserved.

109.3.3 Reinforcing steel and structural frames. Reinforcing steel or structural frame work of any part of any building or structure shall not be covered or concealed without first obtaining a release from the building official.

109.3.4 Termites. Building components and building surroundings required to be protected from termite damage in accordance with Section 1503.6, Section 2304.13 or Section 2304.11.6, specifically required to be inspected for termites in accordance with Section 2114, or required to have chemical soil treatment in accordance with Section 1816 shall not be covered or concealed until the release from the building official has been received.

109.3.5 Shoring. For threshold buildings, shoring and associated formwork or falsework shall be designed and inspected by a Florida licensed professional engineer, employed by the permit holder or subcontractor, prior to any required mandatory inspections by the threshold building inspector.

109.3.6 Threshold building.

109.3.6.1 The enforcing agency shall require a special inspector to perform structural inspections on a threshold building pursuant to a structural inspection plan prepared by the engineer or architect of record. The structural inspection plan must be submitted to the enforcing agency prior to the issuance of a building permit for the construction of a threshold building. The purpose of the structural inspection plans is to provide specific inspection procedures and schedules so that the building can be adequately inspected for compliance with the permitted documents. The special inspector may not serve as a surrogate in carrying out the responsibilities of the building official, the architect or the engineer of record. The contractor's contractual or statutory obligations are not relieved by any action of the special inspector.

109.3.6.2 The special inspector shall determine that a professional engineer who specializes in shoring design has inspected the shoring and reshoring for conformance with the shoring and reshoring plans submitted to the enforcing agency. A fee simple title owner of a building, which does not meet the minimum size, height, occupancy, occupancy classification or number-of-stories criteria which would result in classification as a threshold building under s. 553.71(7), may designate such building as a threshold building, subject to more than the minimum number of inspections required by the *Florida Building Code*.

109.3.6.3 The fee owner of a threshold building shall select and pay all costs of employing a special inspector, but the special inspector shall be responsible to the enforcement agency. The inspector shall be a person certified, licensed or registered under Chapter 471, *Florida Statutes*, as an engineer or under Chapter 481, *Florida Statutes*, as an architect.

109.3.6.4 Each enforcement agency shall require that, on every threshold building:

109.3.6.4.1 The special inspector, upon completion of the building and prior to the issuance of a certificate of occupancy, file a signed and sealed statement with the enforcement agency in substantially the following form: "To the best of my knowledge and belief, the above described construction of all structural load-bearing components complies with the permitted documents, and the shoring and reshoring conforms to the shoring and reshoring plans submitted to the enforcement agency."

109.3.6.4.2 Any proposal to install an alternate structural product or system to which building codes apply be submitted to the enforcement agency for review for compliance with the codes and made part of the enforcement agency's recorded set of permit documents.

109.3.6.4.3 All shoring and reshoring procedures, plans and details be submitted to the enforcement agency for recordkeeping. Each shoring and reshoring installation shall be supervised, inspected and certified to be in compliance with the shoring documents by the contractor.

109.3.6.4.4 All plans for the building which are required to be signed and sealed by the architect or engineer of record contain a statement that, to the best of the architect's or engineer's knowledge, the plans and specifications comply with the applicable minimum building codes and the applicable fire-safety standards as determined by the local authority in accordance with this section and Chapter 633, *Florida Statutes*.

109.3.6.5 No enforcing agency may issue a building permit for construction of any threshold building except to a licensed general contractor, as defined in Section 489.105(3)(a), *Florida Statutes*, or to a licensed building contractor, as defined in Section 489.105(3)(b), *Florida Statutes*, within the scope of her or his license. The named contractor to whom the building permit is issued shall have the responsibility for supervision, direction, management and control of the construction activities on the project for which the building permit was issued.

109.3.6.6 The building department may allow a special inspector to conduct the minimum structural inspection of threshold buildings required by this code, Section 553.73, *Florida Statutes*, without duplicative inspection by the building department. The building official is responsible for ensuring that any person conducting inspections is qualified as a building inspector under Part XII of Chapter 468, *Florida Statutes*, or certified as a special inspector under Chapter 471 or 481, *Florida Statutes*. Inspections of threshold buildings required by Section 553.79(5), *Florida Statutes*, are in addition to the minimum inspections required by this code.

109.3.7 Energy efficiency inspections. Reserved.

109.3.8 Other inspections. Reserved.

109.3.9 Special inspections. Reserved.

109.3.10 Final inspection. Reserved.

109.4 Inspection agencies. Reserved.

109.5 Inspection requests. It shall be the duty of the holder of the building permit or their duly authorized agent to notify the building official when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

109.6 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the building official. The building official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.

SECTION 110
CERTIFICATES OF OCCUPANCY AND COMPLETION

110.1 Use and occupancy. No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made until the building official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction.

110.2 Certificate issued. After the building official inspects the building or structure and finds no violations of the provisions of this code or other laws that are enforced by the department of building safety, the building official shall issue a certificate of occupancy that contains the following:

1. The building permit number.
2. The address of the structure.
3. The name and address of the owner.
4. A description of that portion of the structure for which the certificate is issued.
5. A statement that the described portion of the structure has been inspected for compliance with the requirements of this code for the occupancy and division of occupancy and the use for which the proposed occupancy is classified.
6. The name of the building official.
7. The edition of the code under which the permit was issued.
8. The use and occupancy, in accordance with the provisions of Chapter 3.
9. The type of construction as defined in Chapter 6.
10. The design occupant load.
11. If an automatic sprinkler system is provided, whether the sprinkler system is required.
12. Any special stipulations and conditions of the building permit.

110.3 Temporary occupancy. The building official is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the permit, provided that such portion or portions shall be occupied safely. The building official shall set a time period during which the temporary certificate of occupancy is valid.

110.4 Certificate of Completion. A Certificate of Completion is proof that a structure or system is complete and for certain

types of permits is released for use and may be connected to a utility system. This certificate does not grant authority to occupy a building, such as shell building, prior to the issuance of a Certificate of Occupancy.

110.5 Revocation. The building official is authorized to, in writing, suspend or revoke a certificate of occupancy or completion issued under the provisions of this code wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure or portion thereof is in violation of any ordinance or regulation or any of the provisions of this code.

SECTION 111
SERVICE UTILITIES

111.1 Connection of service utilities. No person shall make connections from a utility, source of energy, fuel or power to any building or system that is regulated by this code for which a permit is required, until released by the building official.

111.2 Temporary connection. The building official shall have the authority to authorize the temporary connection of the building or system to the utility source of energy, fuel or power.

111.3 Authority to disconnect service utilities. The building official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the codes referenced in case of emergency where necessary to eliminate an immediate hazard to life or property. The building official shall notify the serving utility, and wherever possible the owner and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

SECTION 112
BOARD OF APPEALS
RESERVED

SECTION 113
VIOLATIONS
RESERVED

SECTION 114
STOP WORK ORDER

114.1 Authority. Whenever the building official finds any work regulated by this code being performed in a manner either contrary to the provisions of this code or dangerous or unsafe, the building official is authorized to issue a stop work order.

114.2 Issuance. The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work will be permitted to resume.

114.3 Unlawful continuance. Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to penalties as prescribed by law.

SECTION 115
UNSAFE STRUCTURES AND EQUIPMENT
RESERVED

CHAPTER 2
DEFINITIONS

SECTION 201
GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Words not defined. Words not defined herein shall have the meanings stated in the *Florida Building Code, Plumbing*, *Mechanical* and *Fuel Gas*, or the *Florida Fire Prevention Code*. Words not defined in the Florida Building Codes shall have the meanings in *Webster's Third New International Dictionary of the English Language, Unabridged*.

201.4 Terms not defined. Reserved.

SECTION 202
DEFINITIONS

AAC MASONRY. See Section 2102.1.

ACCESSIBLE. See Section 11-3.5.

ACCESSIBLE MEANS OF EGRESS. See Section 1002.1.

ACCESSIBLE ROUTE. See Section 11-3.5.

ACCESSIBLE UNIT. Reserved.

ACCREDITATION BODY. See Section 2302.1.

ADDITION. An extension or increase in floor area or height of a building or structure.

ADHERED MASONRY VENEER. See Section 1402.1.

ADOBE CONSTRUCTION. See Section 2102.1.

Adobe, stabilized. See Section 2102.1.

Adobe, unstabilized. See Section 2102.1.

[F] AEROSOL. See Section 307.2.

Level 1 aerosol products. See Section 307.2.

Level 2 aerosol products. See Section 307.2.

Level 3 aerosol products. See Section 307.2.

[F] AEROSOL CONTAINER. See Section 307.2.

AGRICULTURAL, BUILDING. A structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. This structure shall not be a place of human habitation or a place of employment where agricultural products are processed, treated or packaged, nor shall it be a place used by the public.

AIR-INFLATED STRUCTURE. See Section 3102.2.

AIR-SUPPORTED STRUCTURE. See Section 3102.2.

Double skin. See Section 3102.2.

Single skin. See Section 3102.2.

AISLE. See Section 1002.1.

AISLE ACCESSWAY. See Section 1002.1.

[F] ALARM NOTIFICATION APPLIANCE. See Section 902.1.

[F] ALARM SIGNAL. See Section 902.1.

[F] ALARM VERIFICATION FEATURE. See Section 902.1.

ALLOWABLE STRESS DESIGN. See Section 1602.1.

ALTERATION. Any construction or renovation to an existing structure other than repair or addition.

ALTERNATING TREAD DEVICE. See Section 1002.1.

ANCHOR. See Section 2102.1.

ANCHOR BUILDING. See Section 402.2.

ANCHORED MASONRY VENEER. See Section 1402.1.

ANNULAR SPACE. See Section 702.1.

[F] ANNUNCIATOR. See Section 902.1.

APPLICABLE GOVERNING BODY. A city, county, state, state agency or other political government subdivision or entity authorized to administer and enforce the provisions of this code, as adopted or amended. Also applies to administrative authority.

APPROVED. Acceptable to the code official or authority having jurisdiction.

APPROVED AGENCY. See Section 1702.1.

APPROVED FABRICATOR. See Section 1702.1.

APPROVED SOURCE. An independent person, firm or corporation, approved by the building official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

ARCHITECT. A Florida-registered architect.

ARCHITECTURAL TERRA COTTA. See Section 2102.1.

AREA. See Section 2102.1.

Bedded. See Section 2102.1.

Gross cross-sectional. See Section 2102.1.

Net cross-sectional. See Section 2102.1.

AREA, BUILDING. See Section 502.1.

AREA OF REFUGE. See Section 1002.1.

AREAWAY. A subsurface space adjacent to a building open at the top or protected at the top by a grating or guard.

ASSISTED LIVING FACILITIES. See Section 310.2, "Residential Care/Assisted living facilities."

ATRIUM. See Section 404.1.1.

ATTIC. The space between the ceiling beams of the top story and the roof rafters.

[F] AUDIBLE ALARM NOTIFICATION APPLIANCE. See Section 902.1.

AUTOCLAVED AERATED CONCRETE (AAC). See Section 2102.1.

[F] AUTOMATIC. See Section 902.1.

[F] AUTOMATIC FIRE-EXTINGUISHING SYSTEM. See Section 902.1.

[F] AUTOMATIC SPRINKLER SYSTEM. See Section 902.1.

[F] AVERAGE AMBIENT SOUND LEVEL. See Section 902.1

AWNING. Any rigid or movable (retractable) roof-like structure, cantilevered, or otherwise entirely supported from a building. An awning is comprised of a lightweight rigid or removable skeleton structure over which an approved cover is attached.

BACKING. See Section 1402.1.

BALCONY, EXTERIOR. See Section 1602.1.

BALED COTTON. See Section 307.2.

BALED COTTON, DENSELY PACKED. See Section 307.2.

[F] BARRICADE. See Section 307.2.

Artificial barricade. See Section 307.2.

Natural barricade. See Section 307.2.

BASE FLOOD. Reserved.

BASE FLOOD ELEVATION. Reserved.

BASEMENT. See Sections 502.1.

BED JOINT. See Section 2102.1.

BLEACHERS. See Section 1002.1.

BOARDING HOUSE. See Section 310.2.

[F] BOILING POINT. See Section 307.2.

BOND BEAM. See Section 2102.1.

BOND REINFORCING. See Section 2102.1.

BRACED WALL LINE. See Section 2302.1.

BRACED WALL PANEL. See Section 2302.1.

BRICK. See Section 2102.1.

Calcium silicate (sand lime brick). See Section 2102.1.

Clay or shale. See Section 2102.1.

Concrete. See Section 2102.1.

BUILDING. Any structure used or intended for supporting or sheltering any use or occupancy.

BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

BUILDING OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

BUILT-UP ROOF COVERING. See Section 1502.1.

BURIAL CHAMBER MAUSOLEUM. A family mausoleum consisting of 6 or fewer casket placement crypts plus a chamber to be used for loading of caskets from the interior of the mausoleum which is not below the level of the ground and which is substantially exposed above ground.

BUTTRESS. See Section 2102.1.

CABLE-RESTRAINED, AIR-SUPPORTED STRUCTURE. See Section 3102.2.

CANOPY. Any fixed roof-like structure, not movable like an awning, and which is cantilevered in whole or in part self-supporting, but having no side walls or curtains other than valances not more than 18 inches (457 mm) deep. Lean-to canopies, fixed umbrellas and similar structures are included in this classification. Structures having side walls or valances more than 18 inches (457 mm) deep shall be classified as a tent as set forth herein.

[F] CARBON DIOXIDE EXTINGUISHING SYSTEMS. See Section 902.1.

CAST STONE. See Section 2102.1.

[F] CEILING LIMIT. See Section 902.1.

CEILING RADIATION DAMPER. See Section 702.1.

CELL. See Section 2102.1.

CEMENT PLASTER. See Section 2502.1.

CERAMIC FIBER BLANKET. See Section 721.1.1.

CERTIFICATE OF COMPLIANCE. See Section 1702.1.

CHAPEL MAUSOLEUM. A mausoleum for the public that has heat or air conditioning, with or without a committal area or office.

CHIMNEY. See Section 2102.1.

CHIMNEY TYPES. See Section 2102.1.

High-heat appliance type. See Section 2102.1.

Low-heat appliance type. See Section 2102.1.

Masonry type. See Section 2102.1.

Medium-heat appliance type. See Section 2102.1.

CIRCULAR STAIRS. See Section 1002.

CIRCULATION PATH. Reserved.

[F] CLEAN AGENT. See Section 902.1.

CLEANOUT. See Section 2102.1.

[F] CLOSED SYSTEM. See Section 307.2.

COLLAR JOINT. See Section 2102.1.

COLLECTOR. See Section 2302.1.

COLUMBARIUM. A permanent structure consisting of niches.

COLUMN, MASONRY. See Section 2102.1.

COMBINATION FIRE/SMOKE DAMPER. See Section 702.1.

[F] COMBUSTIBLE DUST. See Section 307.2.

[F] COMBUSTIBLE FIBERS. See Section 307.2.

[F] COMBUSTIBLE LIQUID. See Section 307.2.

Class II. See Section 307.2.

Class IIIA. See Section 307.2.

Class IIIB. See Section 307.2.

COMMISSION. The Florida Building Commission.

COMMON PATH OF EGRESS TRAVEL. See Section 1002.1.

COMMON USE. Reserved.

COMPANION CRYPT. A permanent chamber in a mausoleum for the containment of human remains of more than one individual.

COMPOSITE ACTION. See Section 2102.1.

COMPOSITE MASONRY. See Section 2102.1.

[F] COMPRESSED GAS. See Section 307.2.

COMPRESSIVE STRENGTH OF MASONRY. See Section 2102.1.

CONCRETE, CARBONATE AGGREGATE. See Section 721.1.1.

CONCRETE, CELLULAR. See Section 721.1.1.

CONCRETE, LIGHTWEIGHT AGGREGATE. See Section 721.1.1.

CONCRETE, PERLITE. See Section 721.1.1.

CONCRETE, SAND-LIGHTWEIGHT. See Section 721.1.1.

CONCRETE, SILICEOUS AGGREGATE. See Section 721.1.1.

CONCRETE, VERMICULITE. See Section 721.1.1.

CONGREGATE LIVING FACILITIES. See Section 310.2.

CONNECTOR. See Section 2102.1.

[F] CONSTANTLY ATTENDED LOCATION. See Section 902.1.

CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit.

CONSTRUCTION TYPES. See Section 602.

Type I. See Section 602.2.

Type II. See Section 602.2.

Type III. See Section 602.3.

Type IV. See Section 602.4.

Type V. See Section 602.5.

[F] CONTINUOUS GAS-DETECTION SYSTEM. See Section 415.2.

[F] CONTROL AREA. See Section 307.2.

CONTROLLED LOW-STRENGTH MATERIAL. A self-compacted, cementitious material used primarily as a backfill in place of compacted fill.

CONVENTIONAL LIGHT-FRAME WOOD CONSTRUCTION. See Section 2302.1.

CORRIDOR. See Section 1002.1.

CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

[F] CORROSIVE. See Section 307.2.

COURT. An open, uncovered space, unobstructed to the sky, bounded on three or more sides by exterior building walls or other enclosing devices.

COVER. See Section 2102.1.

COVERED MALL BUILDING. See Section 402.2.

CRANE LOAD. The dead, live and impact loads and forces resulting from the operation of permanent cranes.

CRIPPLE WALL. See Section 2302.1.

CRYOGENIC FLUID. See Section 307.2.

CRYPT. A permanent chamber in a mausoleum for the containment of human remains.

DALLE GLASS. See Section 2402.1.

DAMPER. See Section 702.1.

DAY BOX. See Section 307.2.

DAY-CARE HOME. A building or a portion of a building in which more than 3 but not more than 12 clients receive care, maintenance and supervision, by other than their relative(s) or legal guardian(s), for less than 24 hour per day.

DAY-CARE OCCUPANCY. A building or a portion of a building in which more than 12 clients receive care, maintenance and supervision, by other than their relative(s) or legal guardian(s), for less than 24 hour per day.

DEAD LOADS. See Section 1602.1.

DECK. See Section 1602.1.

DECORATIVE CEMENTITIOUS COATING. A skim coat, as defined in ASTM C 926, of portland cement based plaster applied to concrete or masonry surfaces intended for cosmetic purposes.

DECORATIVE GLASS. See Section 2402.1.

[F] DECORATIVE MATERIALS. All materials applied over the building interior finish for decorative, acoustical or other effect (such as curtains, draperies, fabrics, streamers and surface coverings), and all other materials utilized for decorative effect (such as batting, cloth, cotton, hay, stalks, straw, vines, leaves, trees, moss and similar items), including foam plastics and materials containing foam plastics. Decorative materials do not include floor coverings, ordinary window shades, interior finish and materials 0.025 inch (0.64 mm) or less in thickness applied directly to and adhering tightly to a substrate.

[F] DEFLAGRATION. See Section 307.2.

[F] DELUGE SYSTEM. See Section 902.1.

DESIGN DISPLACEMENT. See Section 1908.1.3.

DESIGN EARTHQUAKE GROUND MOTION. Reserved.

DESIGN FLOOD. Reserved.

DESIGN FLOOD ELEVATION. Reserved.

DESIGN STRENGTH. See Section 1602.1.

DESIGNATED SEISMIC SYSTEM. Reserved.

[F] DETACHED BUILDING. See Section 307.2.

DETAILED PLAIN CONCRETE STRUCTURAL WALL. See Section 1908.1.3.

DETECTABLE WARNING. See Section 11-3.

[F] DETECTOR, HEAT. See Section 902.1.

[F] DETONATION. See Section 307.2.

DIAPHRAGM. See Sections 1602.1 and 2102.1.

Diaphragm, blocked. See Sections 1602.1.

Diaphragm, boundary. See Section 1602.1.

Diaphragm, chord. See Section 1602.1.

Diaphragm, flexible. See Section 1602.1.

Diaphragm, rigid. See Section 1602.1.

Diaphragm, unblocked. See Section 2302.1.

DIMENSIONS. See Section 2102.1.

Actual. See Section 2102.1.

Nominal. See Section 2102.1.

Specified. See Section 2102.1.

DISPENSING. See Section 307.2.

DOOR, BALANCED. See Section 1002.1.

DORMITORY. See Section 310.2.

DRAFTSTOP. See Section 702.1.

DRAG STRUT. See Section 2302.1.

[F] DRY-CHEMICAL EXTINGUISHING AGENT. See Section 902.1.

DRY FLOODPROOFING. Reserved.

DURATION OF LOAD. See Section 1602.1.

DWELLING. A building that contains one or two dwelling units used, intended or designed to be used, rented, leased, let or hired out to be occupied for living purposes.

DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

DWELLING UNIT OR SLEEPING UNIT, MULTI-STORY. Reserved.

DWELLING UNIT OR SLEEPING UNIT, TYPE A. Reserved.

DWELLING UNIT OR SLEEPING UNIT, TYPE B. Reserved.

EFFECTIVE HEIGHT. See Section 2102.1.

EGRESS COURT. See Section 1002.1.

[F] EMERGENCY ALARM SYSTEM. See Section 902.1.

[F] EMERGENCY CONTROL STATION. See Section 415.2.

EMERGENCY ESCAPE AND RESCUE OPENING. See Section 1002.1.

[F] EMERGENCY VOICE/ALARM COMMUNICATIONS. See Section 902.1.

EMPLOYEE WORK AREA. Reserved.

ENFORCEMENT AGENCY.

Local enforcement agency. Means an agency of local government with authority to make inspections of buildings and to enforce the codes which establish standards for design, construction, erection, alteration, repair, modification or demolition of public or private buildings, structures or facilities.

State enforcement agency. Means the agency of state government with authority to make inspections of buildings and to enforce the codes, as required by this part, which establish standards for design, construction, erection, alteration, repair, modification or demolition of public or private buildings, structures or facilities.

ENGINEER. A Florida-licensed professional engineer.

EQUIPMENT PLATFORM. See Section 502.1.

ESSENTIAL FACILITIES. See Section 1602.1.

[F] EXHAUSTED ENCLOSURE. See Section 415.2.

EXISTING CONSTRUCTION. Reserved.

EXISTING STRUCTURE. A structure erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.

EXIT. See Section 1002.1.

EXIT, HORIZONTAL. See Section 1002.1.

EXIT ACCESS. See Section 1002.1.

EXIT DISCHARGE. See Section 1002.1.

EXIT DISCHARGE, LEVEL OF. See Section 1002.1.

EXIT ENCLOSURE. See Section 1002.1.

EXIT PASSAGEWAY. See Section 1002.1.

EXPANDED VINYL WALL COVERING. See Section 802.1.

[F] EXPLOSION. See Section 902.1.

[F] EXPLOSIVE. See Section 307.2.

High explosive. See Section 307.2.

Low explosive. See Section 307.2.

Mass detonating explosives. See Section 307.2.

UN/DOTn Class 1 Explosives. See Section 307.2.

Division 1.1. See Section 307.2.

Division 1.2. See Section 307.2.

Division 1.3. See Section 307.2.

Division 1.4. See Section 307.2.

Division 1.5. See Section 307.2.

Division 1.6. See Section 307.2.

EXTERIOR SURFACES. See Section 2502.1.

EXTERIOR WALL. See Section 1402.1.

EXTERIOR WALL COVERING. See Section 1402.1.

EXTERIOR WALL ENVELOPE. See Section 1402.1.

F RATING. See Section 702.1.

FABRIC COVERED FRAMEWORK (FCF). A nonpressurized structure which is composed of a rigid framework to support tensioned membrane or fabric which provides the weather barrier.

FABRIC PARTITIONS. See Section 1602.1.

FABRICATED ITEM. See Section 1702.1.

[F] FABRICATION AREA. See Section 415.2.

FACILITY. See Section 11-3.5.

FACTORED LOAD. See Section 1602.1.

FAMILY DAY CARE HOME. Family day care home means an occupied residence in which child care is regularly provided for at least two unrelated families which receive payment, fee, or grant for any of the children receiving care, whether or not operated for profit. A family day care home shall be allowed to care for one of the following groups of children, which shall include those children under 13 years of age who are related to the care giver: A. A maximum of four children from birth to 12 months of age. B. A maximum of three children to birth to 12 years of age and other children for maximum total of six children. C. A maximum of six preschool children if all are older than 12 months of age. D. A maximum of 10 children if no more than five are preschool age and, of those five, no more than two are under 12 months of age.

FAMILY MAUSOLEUM. A mausoleum for the private use of a family or group of family members.

FIBER CEMENT SIDING. See Section 1402.1.

FIBERBOARD. See Section 2302.1.

FIRE ALARM BOX, MANUAL. See Section 902.1.

[F] FIRE ALARM CONTROL UNIT. See Section 902.1.

[F] FIRE ALARM SIGNAL. See Section 902.1.

[F] FIRE ALARM SYSTEM. See Section 902.1.

FIRE AREA. See Section 702.1.

FIRE BARRIER. See Section 702.1.

[F] FIRE COMMAND CENTER. See Section 902.1.

FIRE DAMPER. See Section 702.1.

[F] FIRE DETECTOR, AUTOMATIC. See Section 902.1.

FIRE DOOR. See Section 702.1.

FIRE DOOR ASSEMBLY. See Section 702.1.

FIRE EXIT HARDWARE. See Section 1002.1.

[F] FIRE LANE. A road or other passageway developed to allow the passage of fire apparatus. A fire lane is not necessarily intended for vehicular traffic other than fire apparatus.

FIRE PARTITION. See Section 702.1.

FIRE PROTECTION RATING. See Section 702.1.

[F] FIRE PROTECTION SYSTEM. See Section 902.1.

FIRE RESISTANCE. See Section 702.1.

FIRE-RESISTANCE RATING. See Section 702.1.

FIRE-RESISTANT JOINT SYSTEM. See Section 702.1.

[F] FIRE SAFETY FUNCTIONS. See Section 902.1.

FIRE SEPARATION DISTANCE. See Section 702.1.

FIRE WALL. See Section 702.1.

FIRE WINDOW ASSEMBLY. See Section 702.1.

FIREBLOCKING. See Section 702.1.

FIREPLACE. See Section 2102.1.

FIREPLACE THROAT. See Section 2102.1.

FIREWORKS. See Section 307.2.

FIREWORKS, 1.3G. See Section 307.2.

FIREWORKS, 1.4G. See Section 307.2.

FLAME SPREAD. See Section 802.1.

FLAME SPREAD INDEX. See Section 802.1.

[F] FLAMMABLE GAS. See Section 307.2.

[F] FLAMMABLE LIQUEFIED GAS. See Section 307.2.

[F] FLAMMABLE LIQUID. See Section 307.2.

Class IA. See Section 307.2.

Class IB. See Section 307.2.

Class IC. See Section 307.2.

[F] FLAMMABLE MATERIAL. See Section 307.2.

[F] FLAMMABLE SOLID. See Section 307.2.

[F] FLAMMABLE VAPORS OR FUMES. See Section 415.2.

[F] FLASH POINT. See Section 307.2.

FLEXIBLE PLAN BUILDINGS. Buildings used for day-care homes which have movable corridor walls and movable partitions of full-height construction with doors leading from rooms to corridors.

FLEXURAL LENGTH. See Section 1808.1.

FLOATING RESIDENTIAL UNIT. Means a structure primarily designed or constructed as a living unit, built on a floating base, which is not designed primarily as a vessel, is not self-propelled although it may be towed about from place to place, and is primarily intended to be anchored or otherwise moored in a fixed location.

FLOOD OR FLOODING. Reserved.

FLOOD DAMAGE-RESISTANT MATERIALS. Reserved.

FLOOD HAZARD AREA. Reserved.

FLOOD HAZARD AREA SUBJECT TO HIGH VELOCITY WAVE ACTION. Reserved.

FLOOD INSURANCE RATE MAP (FIRM). Reserved.

FLOOD INSURANCE STUDY. Reserved.

FLOODWAY. Reserved.

FLOOR AREA, GROSS. See Section 1002.1.

FLOOR AREA, NET. See Section 1002.1.

FLOOR FIRE DOOR ASSEMBLY. A combination of a fire door, a frame, hardware and other accessories, installed in a horizontal plane, which together provide a specific degree of fire protection to a through opening in a fire rated floor.

FLY GALLERY. See Section 410.2.

[F] FOAM-EXTINGUISHING SYSTEMS. See Section 902.1.

FOAM PLASTIC INSULATION. See Section 2602.1.

FOLDING AND TELESCOPIC SEATING. See Section 1002.1.

FOOD COURT. See Section 402.2.

FOUNDATION PIER. See Section 2102.1.

FRAMEWORK. A skeletal or structural frame; an openwork frame structure.

GARDEN MAUSOLEUM. A mausoleum for the public built without heat or air conditioning but may contain an open-air committal area.

[F] GAS CABINET. See Section 415.2.

[F] GAS ROOM. See Section 415.2.

[F] GASEOUS HYDROGEN SYSTEM. See Section 420.2.

GLASS FIBERBOARD. See Section 721.1.1.

GLUED BUILT-UP MEMBER. See Section 2302.1.

GRADE FLOOR OPENING. A window or other opening located such that the sill height of the opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

GRADE (LUMBER). See Section 2302.1.

GRADE PLANE. See Section 502.1.

GRANDSTAND. See Section 1002.1.

GRIDIRON. See Section 410.2.

GROSS LEASABLE AREA. See Section 402.2.

GROUP DAY CARE HOME. A day care home in which at least 7 but not more than 12 client receive care, maintenance and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day with no more than 3 clients incapable of self-preservation.

GROUTED MASONRY. See Section 2102.1.

Grouted hollow-unit masonry. See Section 2102.1.

Grouted multiwythe masonry. See Section 2102.1.

GUARD. See Section 1002.1.

GYPSUM BOARD. See Section 2502.1.

GYPSUM PLASTER. See Section 2502.1.

GYPSUM VENEER PLASTER. See Section 2502.1.

HABITABLE SPACE. A space in a structure for living, sleeping, eating or cooking. Bathrooms, toilet compartments, closets, halls, screen enclosures, sunroom Categories I, II and III as defined in the AAMA/NPEA/NSA 2100, storage or utility space and similar areas are not considered habitable space.

[F] HALOGENATED EXTINGUISHING SYSTEMS. See Section 902.1.

[F] HANDLING. See Section 307.2.

HANDRAIL. See Section 1002.1.

HARDBOARD. See Section 2302.1.

[F] HAZARDOUS MATERIALS. See Section 307.2.

[F] HAZARDOUS PRODUCTION MATERIAL (HPM). See Section 415.2.

HEAD JOINT. See Section 2102.1.

HEADER (Bonder). See Section 2102.1.

[F] HEALTH HAZARD. See Section 307.2.

HEATING. See Chapter 28 of the *Florida Building Code, Building* and the *Florida Building Code, Mechanical.*

HEIGHT, BUILDING. See Section 502.1.

HEIGHT, STORY. See Section 502.1.

HEIGHT, THRESHOLD BUILDING. The height of the building is at the mean distance between the eaves and the ridge of the roofing structure. If the distance from grade to the line which is the mean distance between the eaves and the ridge of the roofing structure is more than 50 feet, the building is to be considered a "threshold building" within the contemplation of the Threshold Building Act.

HEIGHT, WALLS. See Section 2102.1.

HELIPORT. See Section 412.5.1.

HELISTOP. See Section 412.5.1.

[F] HIGHLY TOXIC. See Section 307.2.

HIGH VELOCITY HURRICANE ZONE. This zone consists of Broward and Miami-Dade counties.

HISTORIC BUILDINGS. Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law (see Chapter 11 of the *Florida Existing Building Code*).

HORIZONTAL ASSEMBLY. See Section 702.1.

[F] HPM FLAMMABLE LIQUID. See Section 415.2.

[F] HPM ROOM. See Section 415.2.

HURRICANE-PRONE REGIONS. See Section 1609.2.

[F] HYDROGEN CUTOFF ROOM. See Section 420.2.

IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH). See Section 415.2.

IMPACT LOAD. See Section 1602.1.

INCOMPATIBLE MATERIALS. See Section 307.2.

[F] INITIATING DEVICE. See Section 902.1.

INSPECTION CERTIFICATE. See Section 1702.1.

INSULATING CONCRETE FORM (ICF). A concrete forming system using stay-in-place forms of rigid foam plastic insulation, a hybrid of cement and foam insulation, a hybrid of cement and wood chips, or other insulating material for constructing cast-in-place concrete walls.

INTENDED TO BE OCCUPIED AS A RESIDENCE. Reserved.

INTERIOR FINISH. See Section 802.1.

INTERIOR FLOOR FINISH. See Section 802.1.

INTERIOR SURFACES. See Section 2502.1.

INTERIOR WALL AND CEILING FINISH. See Section 802.1.

INTERLAYMENT. See Section 1502.1.

JOINT. See Section 702.1.

JURISDICTION. The governmental unit that has adopted this code under due legislative authority.

LABEL. See Section 1702.1.

LANDSCAPE ARCHITECT. A Florida-registered landscape architect.

LIGHT-DIFFUSING SYSTEM. See Section 2602.1.

LIGHT-FRAME CONSTRUCTION. A type of construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or light gage steel framing members.

LIGHT-TRANSMITTING PLASTIC ROOF PANELS. See Section 2602.1.

LIGHT-TRANSMITTING PLASTIC WALL PANELS. See Section 2602.1.

LIMIT STATE. See Section 1602.1.

[F] LIQUID. See Section 415.2.

[F] LIQUID STORAGE ROOM. See Section 415.2.

[F] LIQUID USE, DISPENSING AND MIXING ROOMS. See Section 415.2.

LISTED. See Section 902.1.

LIVE LOADS. See Section 1602.1.

LIVE LOADS (ROOF). See Section 1602.1.

LOAD AND RESISTANCE FACTOR DESIGN (LRFD). See Section 1602.1.

LOAD EFFECTS. See Section 1602.1.

LOAD FACTOR. See Section 1602.1.

LOADS. See Section 1602.1.

LOT. A portion or parcel of land considered as a unit.

LOT LINE. A line dividing one lot from another, or from a street or any public place.

[F] LOWER FLAMMABLE LIMIT (LFL). See Section 415.2.

LOWEST FLOOR. Reserved.

MAIN WINDFORCE-RESISTING SYSTEM. See Section 1702.1.

MALL. See Section 402.2.

[F] MANUAL FIRE ALARM BOX. See Section 902.1.

MANUFACTURER'S DESIGNATION. See Section 1702.1.

MARK. See Section 1702.1.

MARQUEE. A permanent roofed structure attached to and supported by the building and that projects into the public right-of-way.

MASONRY. See Section 2102.1.

Ashlar masonry. See Section 2102.1.

Coursed ashlar. See Section 2102.1.

Glass unit masonry. See Section 2102.1.

Plain masonry. See Section 2102.1.

Random ashlar. See Section 2102.1.

Reinforced masonry. See Section 2102.1.

Solid masonry. See Section 2102.1.

Unreinforced (plain) masonry. See Section 2102.1.

MASONRY UNIT. See Section 2102.1.

Clay. See Section 2102.1.

Concrete. See Section 2102.1.

Hollow. See Section 2102.1.

Solid. See Section 2102.1.

MATERIAL CODE VIOLATION. A material code violation is a violation that exists within a completed building, structure or facility which may reasonably result, or has resulted, in physical harm to a person or significant damage to the performance of a building or its systems.

MATERIAL VIOLATION. As defined in *Florida Statutes*.

MAUSOLEUM. A permanent structure or building which is substantially exposed above the ground and is intended for the interment, entombment, or inurnment of human remains.

MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION. Reserved.

MEAN DAILY TEMPERATURE. See Section 2102.1.

MEANS OF EGRESS. See Section 1002.1.

MEANS OF ESCAPE. See Section 1002.

MECHANICAL-ACCESS OPEN PARKING GARAGES. See Section 406.3.2.

MECHANICAL EQUIPMENT SCREEN. See Section 1502.1.

MECHANICAL SYSTEMS. Reserved.

MEMBRANE-COVERED CABLE STRUCTURE. See Section 3102.2.

MEMBRANE-COVERED FRAME STRUCTURE. See Section 3102.2.

MEMBRANE PENETRATION. See Section 702.1.

MEMBRANE-PENETRATION FIRESTOP. See Section 702.1.

MERCHANDISE PAD. See Section 1002.1.

METAL COMPOSITE MATERIAL (MCM). See Section 1402.1.

METAL COMPOSITE MATERIAL (MCM) SYSTEM. See Section 1402.1.

METAL ROOF PANEL. See Section 1502.1.

METAL ROOF SHINGLE. See Section 1502.1.

MEZZANINE. See Section 502.1.

MICROPILES. See Section 1808.1.

MINERAL BOARD. See Section 721.1.1.

MINERAL FIBER. See Section 702.1.

MINERAL WOOL. See Section 702.1.

MODIFIED BITUMEN ROOF COVERING. See Section 1502.1.

MORTAR. See Section 2102.1.

MORTAR, SURFACE-BONDING. See Section 2102.1.

MULTILEVEL ASSEMBLY SEATING. Reserved.

[F] MULTIPLE-STATION ALARM DEVICE. See Section 902.1.

[F] MULTIPLE-STATION SMOKE ALARM. See Section 902.1.

MULTISTORY UNITS. Reserved.

NAILING, BOUNDARY. See Section 2302.1.

NAILING, EDGE. See Section 2302.1.

NAILING, FIELD. See Section 2302.1.

NATURALLY DURABLE WOOD. See Section 2302.1.

Decay resistant. See Section 2302.1.

Termite resistant. See Section 2302.1.

NICHE. A permanent chamber in a columbarium or mausoleum to hold the cremated remains of one or more individuals.

NOMINAL LOADS. See Section 1602.1.

NOMINAL SIZE (LUMBER). See Section 2302.1.

NONCOMBUSTIBLE MEMBRANE STRUCTURE. See Section 3102.2.

NONVISITATION CRYPT MAUSOLEUM. A mausoleum for the public where the crypts are not accessible to the public.

[F] NORMAL TEMPERATURE AND PRESSURE (NTP). See Section 415.2.

NOSING. See Section 1002.1.

[F] NUISANCE ALARM. See Section 902.1.

OCCUPANCY CATEGORY. See Section 1602.1.

OCCUPANT LOAD. See Section 1002.1.

OCCUPIABLE SPACE. A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes or in which occupants are engaged at labor, and which is equipped with means of egress and light and ventilation facilities meeting the requirements of this code.

OPEN PARKING GARAGE. See Section 406.3.2.

OPEN PLAN BUILDINGS. Buildings used for day-care homes which have rooms and corridors delineated by tables, chairs, desks, bookcases, counters, low-height [maximum 5-ft (1.5-m)] partitions, or similar furnishings.

[F] OPEN SYSTEM. See Section 307.2.

OPENINGS. Apertures or holes in a building envelope and which are designed as "open" during design winds as defined by these provisions.

OPERATING BUILDING. See Section 307.2.

ORDINARY PRECAST STRUCTURAL WALL. See Section 1908.1.3.

ORDINARY REINFORCED CONCRETE STRUCTURAL WALL. See Section 1908.1.3.

ORDINARY STRUCTURAL PLAIN CONCRETE WALL. See Section 1908.1.3.

[F] ORGANIC PEROXIDE. See Section 307.2.

Class I. See Section 307.2.

Class II. See Section 307.2.

Class III. See Section 307.2.

Class IV. See Section 307.2.

Class V. See Section 307.2.

Unclassified detonable. See Section 307.2.

ORTHOGONAL. Reserved.

OTHER STRUCTURES. See Section 1602.1.

OWNER. Any person, agent, firm or corporation having a legal or equitable interest in the property.

[F] OXIDIZER. See Section 307.2.

Class 4. See Section 307.2.

Class 3. See Section 307.2.

Class 2. See Section 307.2.

Class 1. See Section 307.2.

[F] OXIDIZING GAS. See Section 307.2.

PANEL (PART OF A STRUCTURE). See Section 1602.1.

PANIC HARDWARE. See Section 1002.1.

PARTICLEBOARD. See Section 2302.1.

PENETRATION FIRESTOP. See Section 702.1.

PENTHOUSE. See Section 1502.1.

PERMIT. An official document or certificate issued by the authority having jurisdiction which authorizes performance of a specified activity.

PERSON. An individual, heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

PERSONAL CARE SERVICE. See Section 310.2.

[F] PHYSICAL HAZARD. See Section 307.2.

[F] PHYSIOLOGICAL WARNING THRESHOLD LEVEL. See Section 415.2.

PIER FOUNDATIONS. See Section 1808.1.

Belled piers. See Section 1808.1.

PILE FOUNDATIONS. See Section 1808.1.

Auger uncased piles. See Section 1808.1.

Caisson piles. See Section 1808.1.

Concrete-filled steel pipe and tube piles. See Section 1808.1.

Driven uncased piles. See Section 1808.1.

Enlarged base piles. See Section 1808.1.

Steel-cased piles. See Section 1808.1.

Timber piles. See Section 1808.1.

PINRAIL. See Section 410.2.

PLANS. All construction drawings and specifications for any structure necessary for the building official to review in order to determine whether a proposed structure, addition or renovation will meet the requirements of this code and other applicable codes.

PLASTIC, APPROVED. See Section 2602.1.

PLASTIC GLAZING. See Section 2602.1.

PLASTIC HINGE. See Section 2102.1.

PLATFORM. See Section 410.2.

POSITIVE ROOF DRAINAGE. See Section 1502.1.

PREFABRICATED WOOD I-JOIST. See Section 2302.1.

PRESERVATIVE-TREATED WOOD. See Section 2302.1.

PRESTRESSED MASONRY. See Section 2102.1.

PRIMARY FUNCTION. See Section 3402.1.

PRISM. See Section 2102.1.

PROSCENIUM WALL. See Section 410.2.

PUBLIC ENTRANCE. Reserved.

PUBLIC-USE AREAS. Reserved.

PUBLIC WAY. See Section 1002.1.

[F] PYROPHORIC. See Section 307.2.

[F] PYROTECHNIC COMPOSITION. See Section 307.2.

RAMP. See Section 1002.1.

RAMP-ACCESS OPEN PARKING GARAGES. See Section 406.3.2.

[F] RECORD DRAWINGS. See Section 902.1.

REFERENCE RESISTANCE (*D*). See Section 2302.1.

REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

REGISTERED TERMITICIDE. Product listed as registered for use as a preventative treatment for termites for new construction by the Florida Department of Agriculture and Consumer Services under authority of Chapter 487, *Florida Statutes*.

REINFORCED PLASTIC, GLASS FIBER. See Section 2602.1.

RELIGIOUS WORSHIP, PLACE OF. A building or portion thereof intended for the performance of religious services.

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

REQUIRED STRENGTH. See Sections 1602.1 and 2102.1.

REROOFING. See Section 1502.1.

RESIDENTIAL AIRCRAFT HANGAR. See Section 412.3.1.

RESIDENTIAL CARE/ASSISTED LIVING FACILITIES. See Section 310.2.

RESIDENT SLEEPING UNIT. A single unit providing sleeping facilities for one or more persons. Resident sleeping units can also include permanent provisions for living, eating and sanitation, but do not include kitchen facilities.

RESISTANCE FACTOR. See Section 1602.1.

RESTRICTED ENTRANCE. Reserved.

RETAINING WALL, SEGMENTAL. A retaining wall formed of modular block units stacked dry without mortar.

RETRACTABLE AWNING. Reserved.

ROOF ASSEMBLY. See Section 1502.1.

ROOF COVERING. See Section 1502.1.

ROOF COVERING SYSTEM. See Section 1502.1.

ROOF DECK. See Section 1502.1.

ROOF RECOVER. See Section 1502.1.

ROOF REPAIR. See Section 1502.1.

ROOF REPLACEMENT. See Section 1502.1.

ROOF VENTILATION. See Section 1502.1.

ROOFTOP STRUCTURE. See Section 1502.1.

RUBBLE MASONRY. See Section 2102.1.

Coursed rubble. See Section 2102.1.

Random rubble. See Section 2102.1.

Rough or ordinary rubble. See Section 2102.1.

RUNNING BOND. See Section 2102.1.

SCISSOR STAIR. See Section 1002.1.

SCREEN ENCLOSURE. A building or part thereof, in whole or in part self-supporting, and having walls of insect screening with or without removable vinyl or acrylic wind break panels and a roof of insect screening, plastic, aluminum or similar lightweight material.

SCUPPER. See Section 1502.1.

SEISMIC DESIGN CATEGORY. Reserved.

SEISMIC-FORCE-RESISTING SYSTEM. Reserved.

SELF-CLOSING. See Section 702.1.

SELF-PRESERVATION. A client who is capable of self-preservation is one who can evacuate the building without direct intervention by a staff member.

SELF-SERVICE STORAGE FACILITY. Reserved.

SEPARATE ATMOSPHERE. The atmosphere that exists between rooms, spaces, or areas that are separated by an approved smoke barrier.

[F] SERVICE CORRIDOR. See Section 415.2.

SERVICE ENTRANCE. Reserved.

SHAFT. See Section 702.1.

SHAFT ENCLOSURE. See Section 702.1.

SHEAR WALL. A wall designed to resist lateral forces parallel to the plane of the wall.

SHELL. See Section 2102.1.

SINGLE-PLY MEMBRANE. See Section 1502.1.

[F] SINGLE-STATION SMOKE ALARM. See Section 902.1.

SITE. Reserved.

SITE CLASS. Reserved.

SITE COEFFICIENTS. Reserved.

SKYLIGHT, UNIT. A factory-assembled, glazed fenestration unit, containing one panel of glazing material that allows for natural lighting through an opening in the roof assembly while preserving the weather-resistant barrier of the roof.

SKYLIGHTS AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls, are included in this definition.

SLEEPING UNIT. A room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.

[F] SMOKE ALARM. See Section 902.1.

SMOKE BARRIER. See Section 702.1.

SMOKE COMPARTMENT. See Section 702.1.

SMOKE DAMPER. See Section 702.1.

[F] SMOKE DETECTOR. See Section 902.1.

SMOKE-DEVELOPED INDEX. See Section 802.1.

SMOKE-PROTECTED ASSEMBLY SEATING. See Section 1002.1.

SMOKEPROOF ENCLOSURE. See Section 902.1.

[F] SOLID. See Section 415.2.

SPECIAL AMUSEMENT BUILDING. See Section 411.2.

SPECIAL INSPECTION. Reserved.

Special inspection, continuous. Reserved.

Special inspection, periodic. Reserved.

SPECIAL FLOOD HAZARD AREA. Reserved.

SPECIFIED. See Section 2102.1.

SPECIFIED COMPRESSIVE STRENGTH OF MASONRY (f'_m). See Section 2102.1.

SPIRAL STAIRS. A stairway with steps that have a central connecting point, and the travel path is a corkscrew or spiral.

SPLICE. See Section 702.1.

SPRAYED FIRE-RESISTANT MATERIALS. See Section 1702.1.

STACK BOND. See Section 2102.1.

STAGE. See Section 410.2.

STAIR. See Section 1002.1.

STAIRWAY. See Section 1002.1.

STAIRWAY, EXTERIOR. See Section 1002.1.

STAIRWAY, INTERIOR. See Section 1002.1.

STAIRWAY, SPIRAL. See Section 1002.1.

[F] STANDPIPE SYSTEM, CLASSES OF. See Section 902.1.

Class I system. See Section 902.1.

Class II system. See Section 902.1.

Class III system. See Section 902.1.

[F] STANDPIPE, TYPES OF. See Section 902.1.

Automatic dry. See Section 902.1.

Automatic wet. See Section 902.1.

Manual dry. See Section 902.1.

Manual wet. See Section 902.1.

Semiautomatic dry. See Section 902.1.

START OF CONSTRUCTION. Reserved.

STEEL CONSTRUCTION, COLD-FORMED. See Section 2202.1.

STEEL JOIST. See Section 2202.1.

STEEL MEMBER, STRUCTURAL. See Section 2202.1.

STEEP SLOPE. A roof slope greater than two units vertical in 12 units horizontal (17-percent slope).

STONE MASONRY. See Section 2102.1.

Ashlar stone masonry. See Section 2102.1.

Rubble stone masonry. See Section 2102.1.

[F] STORAGE, HAZARDOUS MATERIALS. See Section 415.2.

STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above (also see "Mezzanine" and Section 502.1). It is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

STORY ABOVE GRADE PLANE. Any story having its finished floor surface entirely above grade plane, except that a basement shall be considered as a story above grade plane where the finished surface of the floor above the basement is:

1. More than 6 feet (1829 mm) above grade plane; or
2. More than 12 feet (3658 mm) above the finished ground level at any point.

STREET. Any public thoroughfare, street, avenue, boulevard or space more than 20 feet (6096 mm) wide which has been dedicated or deeded for vehicular use by the public and which can be used for access by fire department vehicles.

STRENGTH. See Section 2102.1.

Design strength. See Section 2102.1.

Nominal strength. See Sections 1602.1 and 2102.1.

Required strength. See Sections 1602.1 and 2102.1.

STRENGTH DESIGN. See Section 1602.1.

STRUCTURAL COMPOSITE LUMBER. See Section 2302.1.

Laminated veneer lumber (LVL). See Section 2302.1.

Parallel strand lumber (PSL). See Section 2302.1.

STRUCTURAL GLUED-LAMINATED TIMBER. See Section 2302.1.

STRUCTURAL OBSERVATION. Reserved.

STRUCTURE. That which is built or constructed.

SUBDIAPHRAGM. See Section 2302.1.

SUBSTANTIAL DAMAGE. Reserved.

SUBSTANTIAL IMPROVEMENT. See Section 3109.1.

SUNROOM. A one-story structure added to an existing dwelling with an open or glazed area in excess of 40 percent of the gross area of the sunroom structure's exterior walls and roof. For the purposes of this code the term "sunroom" as used herein, shall include conservatories, sun spaces, solariums, and porch or patio covers or enclosures.

SUNROOM ADDITION. See Section 1202.1.

[F] SUPERVISING STATION. See Section 902.1.

[F] SUPERVISORY SERVICE. See Section 902.1.

[F] SUPERVISORY SIGNAL. See Section 902.1.

[F] SUPERVISORY SIGNAL-INITIATING DEVICE. See Section 902.1.

SWIMMING POOLS. See Section 424.2.1.

T RATING. See Section 702.1.

TECHNICALLY INFEASIBLE. Reserved.

TENANT. Any person, agent, firm, corporation or division who uses or occupies land, a building or portion of a building by title, under a lease, by payment of rent or who exercises limited control over the space.

TENT. Any structure, enclosure or shelter which is constructed of canvas or pliable material supported in any manner except by air or the contents it protects.

THERMAL ISOLATION. See Section 1202.1.

THERMOPLASTIC MATERIAL. See Section 2602.1.

THERMOSETTING MATERIAL. See Section 2602.1.

THIN-BED MORTAR. See Section 2102.1.

THRESHOLD BUILDING. In accordance with *Florida Statute*, any building which is greater than three stories or 50 feet in height, or which has an assembly occupancy classification that exceeds 5,000 square feet in area and an occupant content of greater than 500 persons.

THROUGH PENETRATION. See Section 702.1.

THROUGH-PENETRATION FIRESTOP SYSTEM. See Section 702.1.

TIE-DOWN (HOLD-DOWN). See Section 2302.1.

TIE, LATERAL. See Section 2102.1.

TIE, WALL. See Section 2102.1.

TILE. See Section 2102.1.

TILE, STRUCTURAL CLAY. See Section 2102.1.

[F] TIRES, BULK STORAGE OF. See Section 902.1.

TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides.

[F] TOXIC. See Section 307.2.

TRANSIENT. See Section 310.2.

TREATED WOOD. See Section 2302.1.

TRIM. See Section 802.1.

[F] TROUBLE SIGNAL. See Section 902.1.

TYPE A UNIT. Reserved.

TYPE B UNIT. Reserved.

UNDERLAYMENT. See Section 1502.1.

[F] UNSTABLE (REACTIVE) MATERIAL. See Section 307.2.

Class 4. See Section 307.2.

Class 3. See Section 307.2.

Class 2. See Section 307.2.

Class 1. See Section 307.2.

[F] USE (MATERIAL). See Section 415.2.

VALUE. The estimated current replacement cost of the building in kind.

VAPOR-PERMEABLE MEMBRANE. A material or covering having a permeance rating of 5 perms (52.9×10^{-10} kg/Pa · s · m^2) or greater, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. A vapor-permeable material permits the passage of moisture vapor.

VAPOR RETARDER. A vapor-resistant material, membrane or covering such as foil, plastic sheeting or insulation facing having a permeance rating of 1 perm (5.7×10^{-11} kg/Pa · s · m^2) or less, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. Vapor retarders limit the

amount of moisture vapor that passes through a material or wall assembly.

VEHICLE BARRIER SYSTEM. See Section 1602.1.

VENEER. See Section 1402.1.

VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VINYL SIDING. See Section 1402.1.

[F] VISIBLE ALARM NOTIFICATION APPLIANCE. See Section 902.1.

WALKWAY, COVERED. A roofed, unobstructed walkway connecting buildings and used as a means of travel by persons and where less than 50 percent of the perimeter is enclosed and the maximum width perpendicular to the direction of travel is less than 30 feet (9144 mm).

WALKWAY, ENCLOSED. A roofed, unobstructed walkway connecting buildings and used as a means of travel by persons and where 50 percent or more of the perimeter is enclosed and the maximum width perpendicular to the direction of travel is less than 30 feet (9144 mm).

WALKWAY, PEDESTRIAN. A walkway used exclusively as a pedestrian trafficway.

WALL. See Section 2102.1.

Cavity wall. See Section 2102.1.

Composite wall. See Section 2102.1.

Dry-stacked, surface-bonded wall. See Section 2102.1.

Masonry-bonded hollow wall. See Section 2102.1.

Parapet wall. See Section 2102.1.

WALL, LOAD-BEARING. Any wall meeting either of the following classifications:

1. Any metal or wood stud wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.
2. Any masonry or concrete wall that supports more than 200 pounds per linear foot (2919 N/m) of vertical load in addition to its own weight.

WALL, NONLOAD-BEARING. Any wall that is not a load-bearing wall.

WALL PIER. See Section 1908.1.3.

[F] WATER-REACTIVE MATERIAL. See Section 307.2.

Class 3. See Section 307.2.

Class 2. See Section 307.2.

Class 1. See Section 307.2.

WATER-RESISTIVE BARRIER. See Section 1402.

WEATHER-EXPOSED SURFACES. See Section 2502.1.

WEB. See Section 2102.1.

[F] WET-CHEMICAL EXTINGUISHING SYSTEM. See Section 902.1.

WHEELCHAIR SPACE. Reserved.

WIND-BORNE DEBRIS IMPACT RESISTANT PRODUCTS. Those products meeting TAS 201, TAS 202 and TAS 203, ASTM E 1886 or ASTM E 1996 or AAMA 506, SSTD 12, or ANSI/DASMA 115.

WIND-BORNE DEBRIS REGION. See Section 1609.2.

WINDER. See Section 1002.1.

WIRE BACKING. See Section 2502.1.

[F] WIRELESS PROTECTION SYSTEM. See Section 902.1.

WOOD SHEAR PANEL. See Section 2302.1.

WOOD STRUCTURAL PANEL. See Section 2302.1.

Composite panels. See Section 2302.1.

Oriented strand board (OSB). See Section 2302.1.

Plywood. See Section 2302.1.

[F] WORKSTATION. See Section 415.2.

WYTHE. See Section 2102.1.

YARD. An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this code, on the lot on which a building is situated.

[F] ZONE. See Section 902.1.

CHAPTER 3
USE AND OCCUPANCY CLASSIFICATION

SECTION 301
GENERAL

301.1 Scope. The provisions of this chapter shall control the classification of all buildings and structures as to use and occupancy.

SECTION 302
CLASSIFICATION

302.1 General. Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed below. Structures with multiple uses shall comply with Section 302.3. Where a structure is proposed for a purpose that is not specifically provided for in this code, such structure shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5
2. Business (see Section 304): Group B
3. Educational (see Section 305): Group E
4. Factory and Industrial (see Section 306): Groups F-1, F-2 and F-3.
5. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5
6. Institutional (see Section 308): Groups I-1, I-2 and I-3
7. Mercantile (see Section 309): Group M
8. Residential (see Section 310): Groups R-1, R-2, R-3 as applicable in Section 101.2, and R-4
9. Storage (see Section 311): Groups S-1 and S-2
10. Utility and Miscellaneous (see Section 312): Group U
11. Day care (see Section 313): Group D

SECTION 303
ASSEMBLY GROUP A

303.1 Assembly Group A. Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption; or awaiting transportation.

Exceptions:

1. A building or tenant space used for assembly purposes with an occupant load of less than 50 persons shall be classified as a Group B occupancy.
2. A room or space used for assembly purposes with an occupant load of less than 50 persons and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.
3. A room or space used for assembly purposes that is less than 750 square feet (70 m^2) in area and is accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.

Assembly occupancies shall include the following:

A-1 Assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures including, but not limited to:

Motion picture theaters
Symphony and concert halls
Television and radio studios admitting an audience
Theaters

A-2 Assembly uses intended for food and/or drink consumption including, but not limited to:

Banquet halls
Night clubs
Restaurants
Taverns and bars

A-3 Assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A including, but not limited to:

Amusement arcades
Art galleries
Bowling alleys
Places of religious worship
Community halls
Courtrooms
Dance halls (not including food or drink consumption)
Exhibition halls
Funeral parlors
Gymnasiums (without spectator seating)
Indoor swimming pools (without spectator seating)
Indoor tennis courts (without spectator seating)
Lecture halls
Libraries
Museums
Waiting areas in transportation terminals
Pool and billiard parlors

A-4 Assembly uses intended for viewing of indoor sporting events and activities with spectator seating including, but not limited to:

Arenas
Skating rinks
Swimming pools
Tennis courts

A-5 Assembly uses intended for participation in or viewing outdoor activities including, but not limited to:

Amusement park structures
Bleachers

Grandstands
Stadiums

303.1.1 Restaurants and drinking establishments with an occupant load of less than 50 persons shall be classified as Group M, mercantile.

SECTION 304
BUSINESS GROUP B

304.1 Business Group B. Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following:

Airport traffic control towers
Animal hospitals, kennels and pounds
Banks
Barber and beauty shops
Car wash
Civic administration
Clinic—outpatient
Dry cleaning and laundries: pick-up and delivery stations and self-service
Educational occupancies for students above the 12th grade
Electronic data processing
Laboratories: testing and research
Motor vehicle showrooms
Post offices
Print shops
Professional services (architects, attorneys, dentists, physicians, engineers, etc.)
Radio and television stations
Telephone exchanges
Training and skill development not within a school or academic program

304.2 Sections 423(1) and 423(2) are applicable to community colleges.

SECTION 305
EDUCATIONAL GROUP E

305.1 Educational Group E. Educational Group E occupancy includes, among others, the use of a building or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade. Religious educational rooms and religious auditoriums, which are accessory to places of religious worship in accordance with Section 508.3.1 and have occupant loads of less than 100, shall be classified as A-3 occupancies.

305.2 Public education occupancies shall comply with Section 423.

SECTION 306
FACTORY GROUP F

306.1 Factory Industrial Group F. Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.

306.2 Factory Industrial F-1 Moderate-hazard Occupancy. Factory industrial uses which are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

Aircraft
Appliances
Athletic equipment
Automobiles and other motor vehicles
Bakeries
Beverages; over 12-percent alcohol content
Bicycles
Boats
Brooms or brushes
Business machines
Cameras and photo equipment
Canvas or similar fabric
Carpets and rugs (includes cleaning)
Clothing
Construction and agricultural machinery
Disinfectants
Dry cleaning and dyeing
Electric generation plants
Electronics
Engines (including rebuilding)
Food processing
Furniture
Hemp products
Jute products
Laundries
Leather products
Machinery
Metals
Millwork (sash & door)
Motion pictures and television filming (without spectators)
Musical instruments
Optical goods
Paper mills or products
Photographic film
Plastic products
Printing or publishing
Recreational vehicles
Refuse incineration
Shoes
Soaps and detergents
Textiles
Tobacco
Trailers
Upholstering
Wood; distillation
Woodworking (cabinet)

306.3 Factory Industrial F-2 Low-hazard Occupancy. Factory industrial uses that involve the fabrication or manufacturing of noncombustible materials which during finishing, packing or processing do not involve a significant fire hazard shall be classified as F-2 occupancies and shall include, but not be limited to, the following:

Beverages; up to and including 12-percent alcohol content
Brick and masonry
Ceramic products
Foundries
Glass products
Gypsum
Ice
Metal products (fabrication and assembly)

306.4 Special purpose F-3. Factory-industrial occupancy includes industrial operations in buildings designed for and suitable only for particular types of operations, characterized by a relatively low density of employee population, with much of the area occupied by machinery or equipment. Group F-3 special purpose factory-industrial occupancy shall include, among others, the occupancies listed in this section: steel mills, paper plants and generating plants.

SECTION 307
HIGH-HAZARD GROUP H

[F] 307.1 High-hazard Group H. High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of those allowed in control areas constructed and located as required in Section 414. Hazardous uses are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this section, the requirements of Section 415 and the *Florida Fire Prevention Code.*

Exceptions: The following shall not be classified in Group H, but shall be classified in the occupancy that they most nearly resemble:

1. Buildings and structures that contain not more than the maximum allowable quantities per control area of hazardous materials as shown in Tables 307.1(1) and 307.1(2), provided that such buildings are maintained in accordance with the *Florida Fire Prevention Code.*
2. Buildings utilizing control areas in accordance with Section 414.2 that contain not more than the maximum allowable quantities per control area of hazardous materials as shown in Tables 307.1(1) and 307.1(2).
3. Buildings and structures occupied for the application of flammable finishes, provided that such buildings or areas conform to the requirements of Section 416 and the *Florida Fire Prevention Code.*
4. Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to the *Florida Fire Prevention Code.*
5. Closed piping system containing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.
6. Cleaning establishments that utilize combustible liquid solvents having a flash point of 140°F (60°C) or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire barriers or 1-hour horizontal assemblies or both.
7. Cleaning establishments that utilize a liquid solvent having a flash point at or above 200°F (93°C).
8. Liquor stores and distributors without bulk storage.
9. Refrigeration systems.
10. The storage or utilization of materials for agricultural purposes on the premises.
11. Stationary batteries utilized for facility emergency power, uninterrupted power supply or telecommunication facilities, provided that the batteries are provided with safety venting caps and ventilation is provided in accordance with the *Florida Building Code, Mechanical.*
12. Corrosives shall not include personal or household products in their original packaging used in retail display or commonly used building materials.
13 Buildings and structures occupied for aerosol storage shall be classified as Group S-1, provided that such buildings conform to the requirements of the *Florida Fire Prevention Code.*
14. Display and storage of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in quantities not exceeding the maximum allowable quantity per control area in Group M or S occupancies complying with Section 414.2.5.
15. The storage of black powder, smokeless propellant and small arms primers in Groups M and R-3 and special industrial explosive devices in Groups B, F, M and S, provided such storage conforms to the quantity limits and requirements prescribed in the *Florida Fire Prevention Code.*
16. Mercantile occupancies offering for retail sale sparklers, novelties and trick noisemakers as defined at Section 791.01, *Florida Statutes*, and that are not defined as fireworks by Chapter 791, *Florida Statutes*. Storage of sparklers and other novelties or trick noisemakers as defined in Chapter 791, *Florida Statutes*, within mercantile occupancies shall be in accordance with Section 791.055, *Florida Statutes.*

307.1.1 Hazardous materials. Hazardous materials in any quantity shall conform to the requirements of this code, including Section 414, and the *Florida Fire Prevention Code.*

[F] 307.2 Definitions. The following words and terms shall, for the purposes of this section and as used elsewhere in this code, have the meanings shown herein.

AEROSOL. A product that is dispensed from an aerosol container by a propellant.

Aerosol products shall be classified by means of the calculation of their chemical heats of combustion and shall be designated Level 1, 2 or 3.

[F] TABLE 307.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible liquid[c, i]	II IIIA IIIB	H-2 or H-3 H-2 or H-3 N/A	N/A	120[d, e] 330[d, e] 13,200[e, f]	N/A	N/A	120[d] 330[d] 13,200[f]	N/A	N/A	30[d] 80[d] 3,300[f]
Combustible fiber	Loose baled[o]	H-3	(100) (1,000)	N/A	N/A	(100) (1,000)	N/A	N/A	(20) (200)	N/A
Consumer fireworks (Class C, Common)	1.4G	H-3	125[d, e, l]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cryogenics flammable	N/A	H-2	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Cryogenics, oxidizing	N/A	H-3	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4G Division 1.5 Division 1.6	H-1 H-1 H-1 or 2 H-3 H-3 H-1 H-1	1[e, g] 1[e, g] 5[e, g] 50[e, g] 125[d, e, l] 1[e, g] 1[d, e, g]	(1)[e, g] (1)[e, g] (5)[e, g] (50)[e, g] N/A (1)[e, g] N/A	N/A N/A N/A N/A N/A N/A N/A	0.25[g] 0.25[g] 1[g] 50[g] N/A 0.25[g] N/A	(0.25)[g] (0.25)[g] (1)[g] (50)[g] N/A (0.25)[g] N/A	N/A N/A N/A N/A N/A N/A N/A	0.25[g] 0.25[g] 1[g] N/A N/A 0.25[g] N/A	(0.25)[g] (0.25)[g] (1)[g] N/A N/A (0.25)[g] N/A
Flammable gas	Gaseous liquefied	H-2	N/A	N/A 30[d, e]	1,000[d, e] N/A	N/A	N/A 30[d, e]	1,000[d, e] N/A	N/A	N/A
Flammable liquid[c]	1A 1B and 1C	H-2 or H-3	N/A	30[d, e] 120[d, e]	N/A	N/A	30[d] 120[d]	N/A	N/A	10[d] 30[d]
Combination flammable liquid (1A, 1B, 1C)	N/A	H-2 or H-3	N/A	120[d, e, h]	N/A	N/A	120[d, h]	N/A	N/A	30[d, h]
Flammable solid	N/A	H-3	125[d, e]	N/A	N/A	125[d]	N/A	N/A	25[d]	N/A
Organic peroxide	UD I II III IV V	H-1 H-2 H-3 H-3 N/A N/A	1[e, g] 5[d, e] 50[d, e] 125[d, e] NL NL	(1)[e, g] (5)[d, e] (50)[d, e] (125)[d, e] NL NL	N/A N/A N/A N/A N/A N/A	0.25[g] 1[d] 50[d] 125[d] N/L N/L	(0.25)[g] (1) (50)[d] (125)[d] N/L N/L	N/A N/A N/A N/A N/A N/A	0.25[g] 1[d] 10[d] 25[d] NL NL	(0.25)[g] (1)[d] (10)[d] (25)[d] NL NL
Oxidizer	4 3[k] 2 1	H-1 H-2 or H-3 H-3 N/A	1[e, g] 10[d, e] 250[d, e] 4,000[e,f]	(1)[e, g] (10)[d, e] (250)[d, e] (4,000)[e,f]	N/A N/A N/A N/A	0.25[g] 2[d] 250[d] 4,000[f]	(0.25)[g] (2)[d] (250)[d] (4,000)[f]	N/A N/A N/A N/A	0.25[g] 2[d] 50[d] 1,000[f]	(0.25)[g] (2)[d] (50)[d] (1,000)[f]
Oxidizing gas	Gaseous liquefied	H-3	N/A N/A	N/A 15[d, e]	1,500[d, e] N/A	N/A N/A	N/A 15[d, e]	1,500[d, e] N/A	N/A N/A	N/A N/A

(continued)

[F] TABLE 307.1(1)—continued
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Pyrophoric material	N/A	H-2	4[e, g]	(4)[e, g]	50[e, g]	1[g]	(1)[g]	10[e, g]	0	0
Unstable (reactive)	4	H-1	1[e, g]	(1)[e, g]	10[d, g]	0.25[g]	(0.25)[g]	2[e, g]	0.25[g]	(0.25)[g]
	3	H-1 or H-2	5[d, e]	(5)[d, e]	50[d, e]	1[d]	(1)	10[d, e]	1[d]	(1)[d]
	2	H-3	50[d, e]	(50)[d, e]	250[d, e]	50[d]	(50)[d]	250[d, e]	10[d]	(10)[d]
	1	N/A	NL	NL	N/L	NL	N/L	NL	NL	NL
Water reactive	3	H-2	5[d, e]	(5)[d, e]	N/A	5[d]	(5)[d]	N/A	1[d]	(1)[d]
	2	H-3	50[d, e]	(50)[d, e]	N/A	50[d]	(50)[d]	N/A	10[d]	(10)[d]
	1	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL

For SI: 1 cubic foot = 0.023 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NL = Not Limited; N/A = Not Applicable; UD = Unclassified Detonable

a. For use of control areas, see Section 414.2.

b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited providing the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.

e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, exhausted enclosures or safety cans. Where Note d also applies, the increase for both notes shall be applied accumulatively.

f. The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

g. Permitted only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

h. Containing not more than the maximum allowable quantity per control area of Class IA, IB or IC flammable liquids.

i. Inside a building, the maximum capacity of a combustible liquid storage system that is connected to a fuel-oil piping system shall be 660 gallons provided such system complies with the *Florida Fire Prevention Code*.

j. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

k. A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes, operation or sanitation of equipment. Storage containers and the manner of storage shall be approved.

l. Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including packaging, shall be used.

m. For gallons of liquids, divide the amount in pounds by 10 in accordance with the *Florida Fire Prevention Code*.

n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).

o. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.

p. The following shall not be included in determining the maximum allowable quantities:

1. Liquid or gaseous fuel in fuel tanks on vehicles.
2. Liquid or gaseous fuel in fuel tanks on motorized equipment operated in accordance with this code.
3. Gaseous fuels in piping systems and fixed appliances regulated by the *Florida Building Code, Fuel Gas*.
4. Liquid fuels in piping systems and fixed appliances regulated by the *Florida Building Code, Mechanical*.

[F] TABLE 307.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIAL POSING A HEALTH HAZARD[a, b, c, j]

MATERIAL	STORAGE[d]			USE-CLOSED SYSTEMS[d]			USE-OPEN SYSTEMS[d]	
	Solid pounds[e, f]	Liquid gallons (pounds)[e, f]	Gas (cubic feet at NTP)[e]	Solid pounds[e]	Liquid gallons (pounds)[e]	Gas (cubic feet at NTP)[e]	Solid pounds[e]	Liquid gallons (pounds)[e]
Corrosive	5,000	500	810[f, g]	5,000	500	810[f, g]	1,000	100
Highly toxic	10	(10)[i]	20[h]	10	(10)[i]	20[h]	3	(3)[i]
Toxic	500	(500)[i]	810[f]	500	(500)[i]	810[f]	125	(125)[i]

For SI: 1 cubic foot = 0.028 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. For use of control areas, see Section 414.2.

b. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics, containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

c. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).

d. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

e. Quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note f also applies, the increase for both notes shall be applied accumulatively.

f. Quantities shall be increased 100 percent when stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the *Florida Fire Prevention Code*. Where Note e also applies, the increase for both notes shall be applied accumulatively.

g. A single cylinder containing 150 pounds or less of anhydrous ammonia in a single control area in a nonsprinklered building shall be considered a maximum allowable quantity. Two cylinders, each containing 150 pounds or less in a single control area, shall be considered a maximum allowable quantity provided the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

h. Allowed only when stored in approved exhausted gas cabinets or exhausted enclosures as specified in the *Florida Fire Prevention Code*.

i. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

j. For gallons of liquids, divide the amount in pounds by 10 in accordance with the *Florida Fire Prevention Code*.

Level 1 aerosol products. Those with a total chemical heat of combustion that is less than or equal to 8,600 British thermal units per pound (Btu/lb) (20 kJ/g).

Level 2 aerosol products. Those with a total chemical heat of combustion that is greater than 8,600 Btu/lb (20 kJ/g), but less than or equal to 13,000 Btu/lb (30 kJ/g).

Level 3 aerosol products. Those with a total chemical heat combustion that is greater than 13,000 Btu/lb (30 kJ/g).

AEROSOL CONTAINER. A metal can or a glass or plastic bottle designed to dispense an aerosol. Metal cans shall be limited to a maximum size of 33.8 fluid ounces (1,000 ml). Glass or plastic bottles shall be limited to a maximum size of 4 fluid ounces (118 ml).

BALED COTTON. A natural seed fiber wrapped in and secured with industry accepted materials, usually consisting of burlap, woven polypropylene, polyethylene or cotton or sheet polyethylene, and secured with steel, synthetic or wire bands or wire; also includes linters (lint removed from the cottonseed) and motes (residual materials from the ginning process).

BALED COTTON, DENSELY PACKED. Cotton made into banded bales with a packing density of at least 22 pounds per cubic foot (360 kg/m^3), and dimensions complying with the following: a length of 55 inches (1397 ± 20 mm), a width of 21 inches (533.4 ± 20 mm) and a height of 27.6 to 35.4 inches (701 to 899 mm).

BARRICADE. A structure that consists of a combination of walls, floor and roof, which is designed to withstand the rapid release of energy in an explosion and which is fully confined, partially vented or fully vented; or other effective method of shielding from explosive materials by a natural or artificial barrier.

Artificial barricade. An artificial mound or revetment a minimum thickness of 3 feet (914 mm).

Natural barricade. Natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine or building containing explosives when the trees are bare of leaves.

BOILING POINT. The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch (psi) (101 kPa) gage or 760 mm of mercury. Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for the purposes of this classification, the 20-percent evaporated point of a distillation performed in accordance with ASTM D 86 shall be used as the boiling point of the liquid.

CLOSED SYSTEM. The use of a solid or liquid hazardous material involving a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations; and all uses of compressed gases. Examples of closed systems for solids and liquids include product conveyed through a piping system into a closed vessel, system or piece of equipment.

COMBUSTIBLE DUST. Finely divided solid material that is 420 microns or less in diameter and which, when dispersed in air in the proper proportions, could be ignited by a flame, spark or other source of ignition. Combustible dust will pass through a U.S. No. 40 standard sieve.

COMBUSTIBLE FIBERS. Readily ignitable and free-burning materials in a fibrous or shredded form, such as cocoa fiber, cloth, cotton, excelsior, hay, hemp, henequen, istle, jute, kapok, oakum, rags, sisal, Spanish moss, straw, tow, wastepaper, cer-

tain synthetic fibers or other like materials. This definition does not include densely packed baled cotton.

COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having a closed cup flash point at or above 200°F (93°C).

The category of combustible liquids does not include compressed gases or cryogenic fluids.

COMPRESSED GAS. A material, or mixture of materials which:

1. Is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure; and
2. Has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa) which is either liquefied, nonliquefied or in solution, except those gases which have no other health- or physical-hazard properties are not considered to be compressed until the pressure in the packaging exceeds 41 psia (282 kPa) at 68°F (20°C).

The states of a compressed gas are categorized as follows:

1. Nonliquefied compressed gases are gases, other than those in solution, which are in a packaging under the charged pressure and are entirely gaseous at a temperature of 68°F (20°C).
2. Liquefied compressed gases are gases that, in a packaging under the charged pressure, are partially liquid at a temperature of 68°F (20°C).
3. Compressed gases in solution are nonliquefied gases that are dissolved in a solvent.
4. Compressed gas mixtures consist of a mixture of two or more compressed gases contained in a packaging, the hazard properties of which are represented by the properties of the mixture as a whole.

CONTROL AREA. Spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled. See also the definition of "Outdoor control area" in the *Florida Fire Prevention Code*.

CORROSIVE. A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. A chemical shall be considered corrosive if, when tested on the intact skin of albino rabbits by the method described in DOTn 49 CFR, Part 173.137, such a chemical destroys or changes irreversibly the structure of the tissue at the point of contact following an exposure period of 4 hours. This term does not refer to action on inanimate surfaces.

CRYOGENIC FLUID. A liquid having a boiling point lower than -150°F (-101°C) at 14.7 pounds per square inch atmosphere (psia) (an absolute pressure of 101 kPa).

DAY BOX. A portable magazine designed to hold explosive materials constructed in accordance with the requirements for a Type 3 magazine as defined and classified in Chapter 33 of the *Florida Fire Prevention Code*.

DEFLAGRATION. An exothermic reaction, such as the extremely rapid oxidation of a flammable dust or vapor in air, in which the reaction progresses through the unburned material at a rate less than the velocity of sound. A deflagration can have an explosive effect.

DETACHED BUILDING. A separate single-story building, without a basement or crawl space, used for the storage or use of hazardous materials and located an approved distance from all structures.

DETONATION. An exothermic reaction characterized by the presence of a shock wave in the material which establishes and maintains the reaction. The reaction zone progresses through the material at a rate greater than the velocity of sound. The principal heating mechanism is one of shock compression. Detonations have an explosive effect.

DISPENSING. The pouring or transferring of any material from a container, tank or similar vessel, whereby vapors, dusts, fumes, mists or gases are liberated to the atmosphere.

EXPLOSIVE. Any chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, igniters and display fireworks, 1.3G (Class B, Special).

The term "explosive" includes any material determined to be within the scope of USC Title 18: Chapter 40 and also includes any material classified as an explosive other than consumer fireworks, 1.4G (Class C, Common) by the hazardous materials regulations of DOTn 49 CFR.

High explosive. Explosive material, such as dynamite, which can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

Low explosive. Explosive material that will burn or deflagrate when ignited. It is characterized by a rate of reaction that is less than the speed of sound. Examples of low explosives include, but are not limited to, black powder; safety fuse; igniters; igniter cord; fuse lighters; fireworks, 1.3G (Class B, Special) and propellants, 1.3C.

Mass-detonating explosives. Division 1.1, 1.2 and 1.5 explosives alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, severe concussion, impact, the impulse of an initiating agent or the effect of a considerable discharge of energy from without. Materials that react in this manner represent a mass explosion hazard. Such an explosive will normally cause severe structural damage to adjacent objects. Explosive propagation could occur immediately to other items of ammunition and explosives stored sufficiently close to and not adequately protected from the initially exploding pile with a time interval short enough so that two or more quantities must be considered as one for quantity-distance purposes.

UN/DOTn Class 1 explosives. The former classification system used by DOTn included the terms "high" and "low" explosives as defined herein. The following terms further define explosives under the current system applied by DOTn for all explosive materials defined as hazard Class 1 materials. Compatibility group letters are used in concert with the division to specify further limitations on each division noted (i.e., the letter G identifies the material as a pyrotechnic substance or article containing a pyrotechnic substance and similar materials).

Division 1.1. Explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously.

Division 1.2. Explosives that have a projection hazard but not a mass explosion hazard.

Division 1.3. Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

Division 1.4. Explosives that pose a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

Division 1.5. Very insensitive explosives. This division is comprised of substances that have a mass explosion hazard, but that are so insensitive there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Division 1.6. Extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

FIREWORKS. Any composition or device for the purpose of producing a visible or audible effect for entertainment purposes by combustion, deflagration or detonation that meets the definition of 1.4G fireworks or 1.3G fireworks as set forth herein.

FIREWORKS, 1.3G. (Formerly Class B, Special Fireworks.) Large fireworks devices, which are explosive materials, intended for use in fireworks displays and designed to produce audible or visible effects by combustion, deflagration or detonation. Such 1.3G fireworks include, but are not limited to, firecrackers containing more than 130 milligrams (2 grains) of explosive composition, aerial shells containing more than 40 grams of pyrotechnic composition, and other display pieces which exceed the limits for classification as 1.4G fireworks. Such 1.3G fireworks are also described as fireworks, UN0335 by the DOTn.

FIREWORKS, 1.4G. (Formerly Class C, Common Fireworks.) Small fireworks devices containing restricted amounts of pyrotechnic composition designed primarily to produce visible or audible effects by combustion. Such 1.4G fireworks which comply with the construction, chemical composition and labeling regulations of the DOTn for fireworks, UN0336, and the U.S. Consumer Product Safety Commission (CPSC) as set forth in CPSC 16 CFR: Parts 1500 and 1507, are not explosive materials for the purpose of this code.

FLAMMABLE GAS. A material that is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure [a material that has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa)] which:

1. Is ignitable at 14.7 psia (101 kPa) when in a mixture of 13 percent or less by volume with air; or
2. Has a flammable range at 14.7 psia (101 kPa) with air of at least 12 percent, regardless of the lower limit.

The limits specified shall be determined at 14.7 psi (101 kPa) of pressure and a temperature of 68°F (20°C) in accordance with ASTM E 681.

FLAMMABLE LIQUEFIED GAS. A liquefied compressed gas which, under a charged pressure, is partially liquid at a temperature of 68°F (20°C) and which is flammable.

FLAMMABLE LIQUID. A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

Class IA. Liquids having a flash point below 73°F (23°C) and a boiling point below 100°F (38°C).

Class IB. Liquids having a flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C).

Class IC. Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C).

The category of flammable liquids does not include compressed gases or cryogenic fluids.

FLAMMABLE MATERIAL. A material capable of being readily ignited from common sources of heat or at a temperature of 600°F (316°C) or less.

FLAMMABLE SOLID. A solid, other than a blasting agent or explosive, that is capable of causing fire through friction, absorption or moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which has an ignition temperature below 212°F (100°C) or which burns so vigorously and persistently when ignited as to create a serious hazard. A chemical shall be considered a flammable solid as determined in accordance with the test method of CPSC 16 CFR; Part 1500.44, if it ignites and burns with a self-sustained flame at a rate greater than 0.1 inch (2.5 mm) per second along its major axis.

FLASH POINT. The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of a liquid shall be determined by appropriate test procedure and apparatus as specified in ASTM D 56, ASTM D 93 or ASTM D 3278.

HANDLING. The deliberate transport by any means to a point of storage or use.

HAZARDOUS MATERIALS. Those chemicals or substances that are physical hazards or health hazards as defined and classified in this section and the *Florida Fire Prevention Code*, whether the materials are in usable or waste condition.

HEALTH HAZARD. A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term "health hazard" includes chemicals that are toxic or highly toxic, and corrosive.

HIGHLY TOXIC. A material which produces a lethal dose or lethal concentration that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD_{50}) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD_{50}) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Mixtures of these materials with ordinary materials, such as water, might not warrant classification as highly toxic. While this system is basically simple in application, any hazard evaluation that is required for the precise categorization of this type of material shall be performed by experienced, technically competent persons.

INCOMPATIBLE MATERIALS. Materials that, when mixed, have the potential to react in a manner that generates heat, fumes, gases or byproducts which are hazardous to life or property.

OPEN SYSTEM. The use of a solid or liquid hazardous material involving a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations. Examples of open systems for solids and liquids include dispensing from or into open beakers or containers, dip tank and plating tank operations.

OPERATING BUILDING. A building occupied in conjunction with the manufacture, transportation or use of explosive materials. Operating buildings are separated from one another with the use of intraplant or intraline distances.

ORGANIC PEROXIDE. An organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical. Organic peroxides can pose an explosion hazard (detonation or deflagration) or they can be shock sensitive. They can also decompose into various unstable compounds over an extended period of time.

Class I. Those formulations that are capable of deflagration but not detonation.

Class II. Those formulations that burn very rapidly and that pose a moderate reactivity hazard.

Class III. Those formulations that burn rapidly and that pose a moderate reactivity hazard.

Class IV. Those formulations that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.

Class V. Those formulations that burn with less intensity than ordinary combustibles or do not sustain combustion and that pose no reactivity hazard.

Unclassified detonable. Organic peroxides that are capable of detonation. These peroxides pose an extremely high explosion hazard through rapid explosive decomposition.

OXIDIZER. A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials. Examples of other oxidizing gases include bromine, chlorine and fluorine.

Class 4. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock. Additionally, the oxidizer will enhance the burning rate and can cause spontaneous ignition of combustibles.

Class 3. An oxidizer that will cause a severe increase in the burning rate of combustible materials with which it comes in contact or that will undergo vigorous self-sustained decomposition due to contamination or exposure to heat.

Class 2. An oxidizer that will cause a moderate increase in the burning rate or that causes spontaneous ignition of combustible materials with which it comes in contact.

Class 1. An oxidizer whose primary hazard is that it slightly increases the burning rate but which does not cause spontaneous ignition when it comes in contact with combustible materials.

OXIDIZING GAS. A gas that can support and accelerate combustion of other materials.

PHYSICAL HAZARD. A chemical for which there is evidence that it is a combustible liquid, compressed gas, cryogenic, explosive, flammable gas, flammable liquid, flammable solid, organic peroxide, oxidizer, pyrophoric or unstable (reactive) or water-reactive material.

PYROPHORIC. A chemical with an autoignition temperature in air, at or below a temperature of 130°F (54.4°C).

PYROTECHNIC COMPOSITION. A chemical mixture that produces visible light displays or sounds through a self-propagating, heat-releasing chemical reaction which is initiated by ignition.

TOXIC. A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD_{50}) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD_{50}) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less

if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.

3. A chemical that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

UNSTABLE (REACTIVE) MATERIAL. A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials. Unstable (reactive) materials are subdivided as follows:

Class 4. Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures. This class includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.

Class 3. Materials that in themselves are capable of detonation or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

Class 2. Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at normal temperatures and pressures, and that can undergo violent chemical change at elevated temperatures and pressures.

Class 1. Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure.

WATER-REACTIVE MATERIAL. A material that explodes; violently reacts; produces flammable, toxic or other hazardous gases; or evolves enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture. Water-reactive materials are subdivided as follows:

Class 3. Materials that react explosively with water without requiring heat or confinement.

Class 2. Materials that react violently with water or have the ability to boil water. Materials that produce flammable, toxic or other hazardous gases or evolve enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture.

Class 1. Materials that react with water with some release of energy, but not violently.

[F] 307.3 High-hazard Group H-1. Buildings and structures containing materials that pose a detonation hazard shall be classified as Group H-1. Such materials shall include, but not be limited to, the following:

Explosives:

Division 1.1
Division 1.2
Division 1.3

Exception: Materials that are used and maintained in a form where either confinement or configuration will not elevate the hazard from a mass fire to mass explosion hazard shall be allowed in H-2 occupancies.

Division 1.4

Exception: Articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco and Firearms regulations, or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles shall be allowed in H-3 occupancies.

Division 1.5
Division 1.6

Organic peroxides, unclassified detonable
Oxidizers, Class 4
Unstable (reactive) materials, Class 3 detonable and Class 4
Detonable pyrophoric materials

[F] 307.4 High-hazard Group H-2. Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2. Such materials shall include, but not be limited to, the following:

Class I, II or IIIA flammable or combustible liquids which are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 psi (103.4 kPa) gage.

Combustible dusts
Cryogenic fluids, flammable
Flammable gases
Organic peroxides, Class I
Oxidizers, Class 3, that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 psi (103 kPa) gage
Pyrophoric liquids, solids and gases, nondetonable
Unstable (reactive) materials, Class 3, nondetonable
Water-reactive materials, Class 3

[F] 307.5 High-hazard Group H-3. Buildings and structures containing materials that readily support combustion or that pose a physical hazard shall be classified as Group H-3. Such materials shall include, but not be limited to, the following:

Class I, II or IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103.4 kPa) or less
Combustible fibers, other than densely packed baled cotton
Consumer fireworks, 1.4G (Class C, Common)
Cryogenic fluids, oxidizing
Flammable solids
Organic peroxides, Class II and III
Oxidizers, Class 2
Oxidizers, Class 3, that are used or stored in normally

closed containers or systems pressurized at 15 pounds per square inch gauge (103 kPa) or less
Oxidizing gases
Unstable (reactive) materials, Class 2
Water-reactive materials, Class 2

[F] 307.6 High-hazard Group H-4. Buildings and structures which contain materials that are health hazards shall be classified as Group H-4. Such materials shall include, but not be limited to, the following:

Corrosives
Highly toxic materials
Toxic materials

[F] 307.7 High-hazard Group H-5 structures. Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 307.1(1) and 307.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.8.

[F] 307.8 Multiple hazards. Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.

SECTION 308
INSTITUTIONAL GROUP I

308.1 Institutional Group I. Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which people are cared for or live in a supervised environment, having physical limitations because of health or age are harbored for medical treatment or other care or treatment, or in which people are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-1, I-2 or I-3.

308.2 Group I-1. This occupancy shall include buildings, structures or parts thereof housing more than 16 persons, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment that provides personal care services. The occupants are capable of responding to an emergency situation without physical assistance from staff. This group shall include, but not be limited to, the following:

Residential board and care facilities
Assisted living facilities
Halfway houses
Group homes
Congregate care facilities
Social rehabilitation facilities
Alcohol and drug centers
Convalescent facilities

A facility such as the above with five or fewer persons shall be classified as a Group R-3 or shall comply with the *Florida Building Code, Residential* in accordance with Section 101.2. A facility such as above, housing at least six and not more than 16 persons, shall be classified as Group R-4.

308.3 Group I-2. This occupancy shall include buildings and structures used for medical, surgical, psychiatric, nursing or custodial care on a 24-hour basis for more than five persons who are not capable of self-preservation. This group shall include, but not be limited to, the following:

Hospitals
Nursing homes (both intermediate care facilities and skilled nursing facilities)
Mental hospitals
Detoxification facilities

A facility such as the above with five or fewer persons shall be classified as Group R-3 or shall comply with the *Florida Building Code, Residential.*

308.3.1 Child care facility. A child care facility that provides care on a 24-hour basis to more than five children $2^1/_2$ years of age or less shall be classified as Group I-2.

308.4 Group I-3. This occupancy shall include buildings and structures that are inhabited by more than five persons who are under restraint or security. An I-3 facility is occupied by persons who are generally incapable of self-preservation due to security measures not under the occupants' control. This group shall include, but not be limited to, the following:

Prisons
Jails
Reformatories
Detention centers
Correctional centers
Prerelease centers

Buildings of Group I-3 shall be classified as one of the occupancy conditions indicated in Sections 308.4.1 through 308.4.5 (see Section 408.1).

308.4.1 Condition 1. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas, and other spaces where access or occupancy is permitted, to the exterior via means of egress without restraint. A Condition 1 facility is permitted to be constructed as Group R.

308.4.2 Condition 2. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas and any other occupied smoke compartment to one or more other smoke compartments. Egress to the exterior is impeded by locked exits.

308.4.3 Condition 3. This occupancy condition shall include buildings in which free movement is allowed within individual smoke compartments, such as within a residential unit comprised of individual sleeping units and group activity spaces, where egress is impeded by remote-controlled release of means of egress from such a smoke compartment to another smoke compartment.

308.4.4 Condition 4. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Remote-controlled release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

308.4.5 Condition 5. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Staff-controlled manual release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

308.5 Group I-4, day care facilities. Reserved.

308.5.1 Adult care facility. Reserved.

308.5.2 Child care facility. Reserved.

SECTION 309
MERCANTILE GROUP M

309.1 Mercantile Group M. Mercantile Group M occupancy includes, among others, buildings and structures or a portion thereof, for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public. Mercantile occupancies shall include, but not be limited to, the following:

Department stores
Drug stores
Markets
Motor fuel-dispensing facilities
Retail or wholesale stores
Restaurants and drinking establishments with an occupant load of less than 50 persons
Sales rooms

309.2 Quantity of hazardous materials. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials stored or displayed in a single control area of a Group M occupancy shall not exceed the quantities in Table 414.2.5(1).

SECTION 310
RESIDENTIAL GROUP R

310.1 Residential Group R. Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the *Florida Building Code, Residential* in accordance with Section 101.2. Residential occupancies shall include the following:

R-1 Residential occupancies containing sleeping units where the occupants are primarily transient in nature, including:

Boarding houses (transient)
Hotels (transient)
Motels (transient)

R-2 Residential occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature, including:

Apartment houses
Boarding houses (not transient)
Convents
Dormitories
Fraternities and sororities
Hotels (nontransient)
Monasteries
Motels (nontransient)
Vacation timeshare properties

Congregate living facilities with 16 or fewer occupants are permitted to comply with the construction requirements for Group R-3.

R-3 Residential occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, R-4 or I, including:

Buildings that do not contain more than two dwelling units.
Adult care facilities that provide accommodations for five or fewer persons of any age for less than 24 hours.
Child care facilities that provide accommodations for five or fewer persons of any age for less than 24 hours.
Congregate living facilities with 16 or fewer persons.

Adult and child care facilities that are within a single-family home are permitted to comply with the *Florida Building Code, Residential.*

R-4 Residential occupancies shall include buildings arranged for occupancy as residential care/assisted living facilities including more than five but not more than 16 occupants, excluding staff.

Group R-4 occupancies shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in this code, or shall comply with the *Florida Building Code, Residential.*

310.2 Definitions. The following words and terms shall, for the purposes of this section and as used elsewhere in this code, have the meanings shown herein.

BOARDING HOUSE. A building arranged or used for lodging for compensation, with or without meals, and not occupied as a single-family unit.

CONGREGATE LIVING FACILITIES. A building or part thereof that contains sleeping units where residents share bathroom and/or kitchen facilities.

DORMITORY. A space in a building where group sleeping accommodations are provided in one room, or in a series of closely associated rooms, for persons not members of the same family group, under joint occupancy and single management, as in college dormitories or fraternity houses.

PERSONAL CARE SERVICE. The care of residents who do not require chronic or convalescent medical or nursing care. Personal care involves responsibility for the safety of the resident while inside the building.

RESIDENTIAL CARE/ASSISTED LIVING FACILITIES. A building or part thereof housing persons, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment which provides personal care services. The occupants are capable of responding to an emergency situation without physical assistance from

staff. This classification shall include, but not be limited to, the following: residential board and care facilities, assisted living facilities, halfway houses, group homes, congregate care facilities, social rehabilitation facilities, alcohol and drug abuse centers and convalescent facilities.

TRANSIENT. Occupancy of a dwelling unit or sleeping unit for not more than 30 days.

SECTION 311
STORAGE GROUP S

311.1 Storage Group S. Storage Group S occupancy includes, among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.

311.2 Moderate-hazard storage, Group S-1. Buildings occupied for storage uses that are not classified as Group S-2, including, but not limited to, storage of the following:

Aerosols, Levels 2 and 3
Aircraft repair hangar
Bags: cloth, burlap and paper
Bamboos and rattan
Baskets
Belting: canvas and leather
Books and paper in rolls or packs
Boots and shoes
Buttons, including cloth covered, pearl or bone
Cardboard and cardboard boxes
Clothing, woolen wearing apparel
Cordage
Dry boat storage (indoor)
Furniture
Furs
Glues, mucilage, pastes and size
Grains
Horns and combs, other than celluloid
Leather
Linoleum
Lumber
Motor vehicle repair garages complying with the maximum allowable quantities of hazardous materials listed in Table 307.1(1) (see Section 406.6)
Photo engravings
Resilient flooring
Silks
Soaps
Sugar
Tires, bulk storage of
Tobacco, cigars, cigarettes and snuff
Upholstery and mattresses
Wax candles

311.3 Low-hazard storage, Group S-2. Includes, among others, buildings used for the storage of noncombustible materials such as products on wood pallets or in paper cartons with or without single thickness divisions; or in paper wrappings. Such products are permitted to have a negligible amount of plastic trim, such as knobs, handles or film wrapping. Storage uses shall include, but not be limited to, storage of the following:

Aircraft hangar
Asbestos
Beverages up to and including 12-percent alcohol in metal, glass or ceramic containers
Cement in bags
Chalk and crayons
Dairy products in nonwaxed coated paper containers
Dry cell batteries
Electrical coils
Electrical motors
Empty cans
Food products
Foods in noncombustible containers
Fresh fruits and vegetables in nonplastic trays or containers
Frozen foods
Glass
Glass bottles, empty or filled with noncombustible liquids
Gypsum board
Inert pigments
Ivory
Meats
Metal cabinets
Metal desks with plastic tops and trim
Metal parts
Metals
Mirrors
Oil-filled and other types of distribution transformers
Parking garages, open or enclosed
Porcelain and pottery
Stoves
Talc and soapstones
Washers and dryers

SECTION 312
UTILITY AND MISCELLANEOUS GROUP U

312.1 General. Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy. Group U shall include, but not be limited to, the following:

Agricultural buildings
Aircraft hangars, accessory to a one- or two-family residence (see Section 412.3)
Barns
Carports
Fences more than 6 feet (1829 mm) high
Grain silos, accessory to a residential occupancy
Greenhouses
Livestock shelters
Private garages
Retaining walls
Sheds
Stables
Tanks
Towers

SECTION 313
DAY-CARE OCCUPANCY GROUP D

313.1 Scope. Group D occupancy is the use of a building or structure, or any portion thereof, in which three or more clients receive care, maintenance and supervision, by other than their relative(s) or legal guardian(s), for less than 24 hours per day. Occupancies that include part-day preschools, kindergartens and other schools whose purpose is primarily educational even though the children are of preschool age shall comply with the provisions for Group E occupancies.

313.2 Subclassifications. Day care occupancies in which more than 12 clients receive care, maintenance and supervision, by other than their relative(s) or legal guardian(s), for less than 24 hours per day shall be classified as day care occupancies. Day care occupancies of 12 or fewer clients shall be classified as day care homes and shall be divided into classifications as set forth in this section.

313.2.1 Family day care home. A family day care home is a day care home in which more than three but fewer than seven clients receive care, maintenance and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day with no more than two clients incapable of self-preservation.

313.2.2 Group day care home. A group day care home is a day-care home in which at least seven but not more than 12 clients receive care, maintenance, and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day with no more than three clients incapable of self-preservation.

313.2.3 Adult day care. Adult day care shall include any building or portion thereof used for less than 24 hours per day to house more than three adults requiring care, maintenance and supervision by other than their relative(s). Clients shall be ambulatory or semiambulatory and shall not be bedridden. They shall not exhibit behavior that is harmful to themselves or others.

313.2.4 Group D occupancies. Group D occupancies shall include, among others, the following:

Child day care occupancies
Adult day care occupancies, except where part of a health care occupancy
Nursery schools
Day care homes
Kindergarten classes that are incidental to a child day care occupancy

In cases where care is incidental to some other occupancy, the section of this code governing such other occupancy shall apply.

CHAPTER 4

SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

SECTION 401
SCOPE

401.1 Detailed use and occupancy requirements. In addition to the occupancy and construction requirements in this code, the provisions of this chapter apply to the special uses and occupancies described herein.

401.2 Additional design criteria.

401.2.1 Scope. In addition to the provisions of this chapter, the following special occupancies, standards, requirements and codes shall conform to the following sections:

Section 419: Hospitals
Section 420: Nursing homes
Section 421: Ambulatory surgical centers
Section 422: Birthing centers
Section 423: State requirements for educational facilities
Section 424: Swimming pools and bathing places
Section 425: Public lodging establishments
Section 426: Public food service establishments
Section 427: Mental health programs
Section 428: Manufactured buildings
Section 429: Boot camps for children
Section 430: Mausoleums and columbariums
Section 431: Transient public lodging establishments
Section 432: Use of asbestos in new public buildings or buildings newly constructed for lease to government entities–prohibition
Section 433: Adult day care
Section 434: Assisted living facilities
Section 435: Control of radiation hazards
Section 436: Day care occupancies
Section 437: Hospice inpatient facilities and units and hospice residences.
Chapter 30: Elevators and conveying systems
Section 3109: Structures seaward of a coastal construction control line
Section 3110: Flood-resistant construction

401.2.2 General. Where in any specific case, Sections 419 through 437 specify different materials, methods of construction, design criteria or other requirements than found in this code, the requirements of Sections 419 through 437 shall be applicable.

401.2.3 Referenced standards. Further information concerning the requirements for licensing, maintenance, equipment or other items not related to design and construction may be obtained for all state codes, rules and standards from the State of Florida Bureau of Administrative Codes.

SECTION 402
COVERED MALL BUILDINGS

402.1 Scope. The provisions of this section shall apply to buildings or structures defined herein as covered mall buildings not exceeding three floor levels at any point nor more than three stories above grade plane. Except as specifically required by this section, covered mall buildings shall meet applicable provisions of this code.

Exceptions:

1. Foyers and lobbies of Groups B, R-1 and R-2 are not required to comply with this section.
2. Buildings need not comply with the provisions of this section when they totally comply with other applicable provisions of this code.

402.1.1 Occupancy. Covered mall buildings shall be classified as Group M occupancies and may contain accessory uses consisting of Group A, B, D, E or R occupancies. Individual accessory uses within a covered mall building shall not exceed the sprinklered area limitation and shall not be located at a height greater than that permitted for such occupancy group in the type of construction being used. The aggregate area of all accessory uses within a covered mall building shall not exceed 25 percent of the gross leasable area.

402.2 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

ANCHOR BUILDING. An exterior perimeter building of a group other than H having direct access to a covered mall building but having required means of egress independent of the mall.

COVERED MALL BUILDING. A single building enclosing a number of tenants and occupants such as retail stores, drinking and dining establishments, entertainment and amusement facilities, passenger transportation terminals, offices, and other similar uses wherein two or more tenants have a main entrance into one or more malls. For the purpose of this chapter, anchor buildings shall not be considered as a part of the covered mall building.

FOOD COURT. A public seating area located in the mall that serves adjacent food preparation tenant spaces.

GROSS LEASABLE AREA. The total floor area designed for tenant occupancy and exclusive use. The area of tenant occupancy is measured from the centerlines of joint partitions to the outside of the tenant walls. All tenant areas, including

areas used for storage, shall be included in calculating gross leasable area.

MALL. A roofed or covered common pedestrian area within a covered mall building that serves as access for two or more tenants and not to exceed three levels that are open to each other.

402.3 Lease plan. Each covered mall building owner shall provide both the building and fire departments with a lease plan showing the location of each occupancy and its exits after the certificate of occupancy has been issued. No modifications or changes in occupancy or use shall be made from that shown on the lease plan without prior approval of the building official.

402.4 Means of egress. Each tenant space and the covered mall building shall be provided with means of egress as required by this section and this code. Where there is a conflict between the requirements of this code and the requirements of this section, the requirements of this section shall apply.

402.4.1 Determination of occupant load. The occupant load permitted in any individual tenant space in a covered mall building shall be determined as required by this code. Means of egress requirements for individual tenant spaces shall be based on the occupant load thus determined.

402.4.1.1 Occupant formula. In determining required means of egress of the mall, the number of occupants for whom means of egress are to be provided shall be based on gross leasable area of the covered mall building (excluding anchor buildings) and the occupant load factor as determined by the following equation.

$$OLF = (0.00007)(GLA) + 25 \qquad \textbf{(Equation 4-1)}$$

where:

OLF = The occupant load factor (square feet per person).

GLA = The gross leasable area (square feet).

402.4.1.2 OLF range. The occupant load factor (OLF) is not required to be less than 30 and shall not exceed 50.

402.4.1.3 Anchor buildings. The occupant load of anchor buildings opening into the mall shall not be included in computing the total number of occupants for the mall.

402.4.1.4 Food courts. The occupant load of a food court shall be determined in accordance with Section 1004. For the purposes of determining the means of egress requirements for the mall, the food court occupant load shall be added to the occupant load of the covered mall building as calculated above.

402.4.2 Number of means of egress. Wherever the distance of travel to the mall from any location within a tenant space used by persons other than employees exceeds 75 feet (22 860 mm) or the tenant space has an occupant load of 50 or more, not less than two means of egress shall be provided.

402.4.3 Arrangements of means of egress. Assembly occupancies with an occupant load of 500 or more shall be so located in the covered mall building that their entrance will be immediately adjacent to a principal entrance to the mall and shall have not less than one-half of their required means of egress opening directly to the exterior of the covered mall building.

402.4.3.1 Anchor building means of egress. Required means of egress for anchor buildings shall be provided independently from the mall means of egress system. The occupant load of anchor buildings opening into the mall shall not be included in determining means of egress requirements for the mall. The path of egress travel of malls shall not exit through anchor buildings. Malls terminating at an anchor building where no other means of egress has been provided shall be considered as a dead-end mall.

402.4.4 Distance to exits. Within each individual tenant space in a covered mall building, the maximum distance of travel from any point to an exit or entrance to the mall shall not exceed 200 feet (60 960 mm).

The maximum distance of travel from any point within a mall to an exit shall not exceed 200 feet (60 960 mm).

402.4.5 Access to exits. Where more than one exit is required, they shall be so arranged that it is possible to travel in either direction from any point in a mall to separate exits. The minimum width of an exit passageway or corridor from a mall shall be 66 inches (1676 mm).

Exception: Dead ends not exceeding a length equal to twice the width of the mall measured at the narrowest location within the dead-end portion of the mall.

402.4.5.1 Exit passageways. Where exit passageways provide a secondary means of egress from a tenant space, doorways to the exit passageway shall be protected by 1-hour fire door assemblies that are self- or automatic closing by smoke detection in accordance with Section 715.4.7.3.

402.4.6 Service areas fronting on exit passageways. Mechanical rooms, electrical rooms, building service areas and service elevators are permitted to open directly into exit passageways, provided the exit passageway is separated from such rooms with not less than 1-hour fire-resistance-rated fire barriers and 1-hour opening protectives. Such rooms or areas shall be protected by an approved supervised automatic sprinkler system in accordance with Section 903; however, the exception in NFPA 13, *Standard for the Installation of Sprinklers*, that permit the omission of sprinklers from such rooms shall not be permitted.

402.5 Mall width. For the purpose of providing required egress, malls are permitted to be considered as corridors but need not comply with the requirements of Section 1005.1 of this code where the width of the mall is as specified in this section.

402.5.1 Minimum width. The minimum width of the mall shall be 20 feet (6096 mm). The mall width shall be sufficient to accommodate the occupant load served. There shall be a minimum of 10 feet (3048 mm) clear exit width to a height of 8 feet (2438 mm) between any projection of a tenant space bordering the mall and the nearest kiosk, vending machine, bench, display opening, food court or other obstruction to means of egress travel.

402.6 Types of construction. The area of any covered mall building, including anchor buildings, of Type I, II, III and IV construction, shall not be limited provided the covered mall building and attached anchor buildings and parking garages are surrounded on all sides by a permanent open space of not less than 60 feet (18 288 mm) and the anchor buildings do not exceed three stories in height. The allowable height and area of anchor buildings greater than three stores in height shall comply with Section 503, as modified by Sections 504 and 506. The construction type of open parking garages and enclosed parking garages shall comply with Sections 406.3 and 406.4, respectively.

402.7 Fire-resistance-rated separation. Fire-resistance-rated separation is not required between tenant spaces and the mall. Fire-resistance-rated separation is not required between a food court and adjacent tenant spaces or the mall.

402.7.1 Attached garage. An attached garage for the storage of passenger vehicles having a capacity of not more than nine persons and open parking garages shall be considered as a separate building where it is separated from the covered mall building by a fire barrier having a fire-resistance rating of at least 2 hours.

Exception: Where an open parking garage or enclosed parking garage is separated from the covered mall building or anchor building a distance greater than 10 feet (3048 mm), the provisions of Table 602 shall apply. Pedestrian walkways and tunnels which attach the open parking garage or enclosed parking garage to the covered mall building or anchor building shall be constructed in accordance with Section 3104.

402.7.2 Tenant separations. Each tenant space shall be separated from other tenant spaces by a fire partition complying with Section 708. A tenant separation wall is not required between any tenant space and the mall.

402.7.3 Anchor building separation. An anchor building shall be separated from the covered mall building by fire walls complying with Section 705.

Exception: Anchor buildings of not more than three stories above grade plane that have an occupancy classification the same as that permitted for tenants of the covered mall building shall be separated by 2-hour fire-resistive fire barriers complying with Section 706.

402.7.3.1 Openings between anchor building and mall. Except for the separation between Group R-1 sleeping units and the mall, openings between anchor buildings of Type IA, IB, IIA and IIB construction and the mall need not be protected.

[F] 402.8 Automatic sprinkler system. The covered mall building and buildings connected shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, which shall comply with the following:

1. The automatic sprinkler system shall be complete and operative throughout occupied space in the covered mall building prior to occupancy of any of the tenant spaces. Unoccupied tenant spaces shall be similarly protected unless provided with approved alternate protection.
2. Sprinkler protection for the mall shall be independent from that provided for tenant spaces or anchors. Where tenant spaces are supplied by the same system, they shall be independently controlled.

Exception: An automatic sprinkler system shall not be required in spaces or areas of open parking garages constructed in accordance with Section 406.2.

[F] 402.8.1 Standpipe system. The covered mall building shall be equipped throughout with a standpipe system as required by Section 905.3.3.

402.9 Smoke control. A smoke control system shall be provided for atriums per Section 909.

402.10 Kiosks. Kiosks and similar structures (temporary or permanent) shall meet the following requirements:

1. Combustible kiosks or other structures shall not be located within the mall unless constructed of any of the following materials:
   1.1. Fire-retardant-treated wood complying with Section 2303.2.
   1.2. Foam plastics having a maximum heat release rate not greater than 100kW (105 Btu/h) when tested in accordance with the exhibit booth protocol in UL 1975.
   1.3. Aluminum composite material (ACM) having a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E 84.
2. Kiosks or similar structures located within the mall shall be provided with approved fire suppression and detection devices.
3. The minimum horizontal separation between kiosks or groupings thereof and other structures within the mall shall be 20 feet (6096 mm).
4. Each kiosk or similar structure or groupings thereof shall have a maximum area of 300 square feet (28 m^2).

402.11 Children's playground structures. Structures intended as children's playgrounds that exceed 10 feet (3048 mm) in height and 150 square feet (14 m^2) in area shall comply with the following.

402.11.1 Materials. Children's playground structures shall be constructed of noncombustible materials or of combustible materials that comply with the following:

1. Fire-retardant-treated wood.
2. Light-transmitting plastics complying with Section 2606.
3. Foam plastics (including the pipe foam used in soft-contained play equipment structures) having a maximum heat-release rate not greater than 100 kW when tested in accordance with UL 1975.
4. Aluminum composite material (ACM) meeting the requirements of Class A interior finish in accordance

with Chapter 8 when tested as an assembly in the maximum thickness intended for use.

5. Textiles and films complying with the flame propagation performance criteria contained in NFPA 701.
6. Plastic materials used to construct rigid components of soft-contained play equipment structures (such as tubes, windows, panels, junction boxes, pipes, slides and decks) meeting the UL 94 V-2 classification when tested in accordance with UL 94.
7. Ball pool balls, used in soft-contained play equipment structures, having a maximum heat release rate not greater than 100 kW when tested in accordance with UL 1975. The minimum specimen test size shall be 36 inches by 36 inches (914 mm by 914 mm) by an average of 21 inches (533 mm) deep, and the balls shall be held in a box constructed of galvanized steel poultry netting wire mesh.
8. Foam plastics shall be covered by a fabric, coating or film meeting the flame propagation performance criteria of NFPA 701.
9. The floor covering placed under the children's playground structure shall exhibit a Class I interior floor finish classification, as described in Section 804, when tested in accordance with NFPA 253.

402.11.2 Fire protection. Children's playground structures located within the mall shall be provided with the same level of approved fire suppression and detection devices required for kiosks and similar structures.

402.11.3 Separation. Children's playground structures shall have a minimum horizontal separation from other structures within the mall of 20 feet (6090 mm).

402.11.4 Area limits. Children's playground structures shall not exceed 300 square feet (28 m^2) in area, unless a special investigation has demonstrated adequate fire safety.

402.12 Security grilles and doors. Horizontal sliding or vertical security grilles or doors that are a part of a required means of egress shall conform to the following:

1. They shall remain in the full open position during the period of occupancy by the general public.
2. Doors or grilles shall not be brought to the closed position when there are 10 or more persons occupying spaces served by a single exit or 50 or more persons occupying spaces served by more than one exit.
3. The doors or grilles shall be openable from within without the use of any special knowledge or effort where the space is occupied.
4. Where two or more exits are required, not more than one-half of the exits shall be permitted to include either a horizontal sliding or vertical rolling grille or door.

[F] 402.13 Standby power. Covered mall buildings exceeding 50,000 square feet (4645 m^2) shall be provided with standby power systems that are capable of operating the emergency voice/alarm communication system.

[F] 402.14 Emergency voice/alarm communication system. Covered mall buildings exceeding 50,000 square feet (4645 m^2) in total floor area shall be provided with an emergency voice/alarm communication system. Emergency voice/alarm communication systems serving a mall, required or otherwise, shall be accessible to the fire department. The system shall be provided in accordance with Section 907.2.12.2.

402.15 Plastic signs. Plastic signs affixed to the storefront of any tenant space facing the mall shall be limited as specified in Sections 402.15.1 through 402.15.5.2.

402.15.1 Area. Plastic signs shall not exceed 20 percent of the wall area facing the mall.

402.15.2 Height and width. Plastic signs shall not exceed a height of 36 inches (914 mm), except if the sign is vertical, the height shall not exceed 96 inches (2438 mm) and the width shall not exceed 36 inches (914 mm).

402.15.3 Location. Plastic signs shall be located a minimum distance of 18 inches (457 mm) from adjacent tenants.

402.15.4 Plastics other than foam plastics. Plastics other than foam plastics used in signs shall be light-transmitting plastics complying with Section 2606.4 or shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929, and a flame spread index not greater than 75 and smoke-developed index not greater than 450 when tested in the manner intended for use in accordance with ASTM E 84 or meet the acceptance criteria of Section 803.2.1 when tested in accordance with NFPA 286.

402.15.4.1 Encasement. Edges and backs of plastic signs in the mall shall be fully encased in metal.

402.15.5 Foam plastics. Foam plastics used in signs shall have flame-retardant characteristics such that the sign has a maximum heat-release rate of 150 kilowatts when tested in accordance with UL 1975 and the foam plastics shall have the physical characteristics specified in this section. Foam plastics used in signs installed in accordance with Section 402.14 shall not be required to comply with the flame spread and smoke-developed indexes specified in Section 2603.3.

402.15.5.1 Density. The minimum density of foam plastics used in signs shall not be less than 20 pounds per cubic foot (pcf) (320 kg/m^3).

402.15.5.2 Thickness. The thickness of foam plastic signs shall not be greater than $^1/_2$ inch (12.7 mm).

[F] 402.16 Fire department access to equipment. Rooms or areas containing controls for air-conditioning systems, automatic fire-extinguishing systems or other detection, suppression or control elements shall be identified for use by the fire department.

SECTION 403
HIGH-RISE BUILDINGS

403.1 Applicability. The provisions of this section shall apply to buildings with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

Exception: The provisions of this section shall not apply to the following buildings and structures:

1. Airport traffic control towers in accordance with Section 412.
2. Open parking garages in accordance with Section 406.3.
3. Buildings with an occupancy in Group A-5 in accordance with Section 303.1.
4. Low-hazard special industrial occupancies in accordance with Section 503.1.1.
5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with Section 415.

403.1.1 Accessibility. For accessibility provisions related to Group B and R occupancies, refer to Sections 11-5, 11-7, 11-9, and 11-11.

[F] 403.2 Automatic sprinkler system. Buildings and structures shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 903.3.5.2.

Exception: An automatic sprinkler system shall not be required in spaces or areas of:

1. Open parking garages in accordance with Section 406.3.
2. Telecommunications equipment buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an automatic fire detection system in accordance with Section 907.2 and are separated from the remainder of the building by fire barriers consisting of not less than 1-hour fire-resistance-rated walls and 2-hour fire-resistance-rated floor/ceiling assemblies.

403.3 Reduction in fire-resistance rating. The fire-resistance-rating reductions listed in Sections 403.3.1 and 403.3.2 shall be allowed in buildings that have sprinkler control valves equipped with supervisory initiating devices and water-flow initiating devices for each floor.

403.3.1 Type of construction. In Type I-A construction the fire-resistance ratings of partitions, columns, trusses, girders, beams and floors may be reduced by 1 hour, but no component or assembly shall be less than 1 hour.

The height and area limitations of the reduced construction type shall be allowed to be the same as for the original construction type.

403.3.2 Shaft enclosures. For buildings not greater than 420 feet (128 m) in height, the required fire-resistance rating of the fire barriers enclosing vertical shafts, other than exit enclosures and elevator hoistway enclosures, shall be reduced to 1 hour where automatic sprinklers are installed within the shafts at the top and at alternate floor levels.

403.4 Emergency escape and rescue. Emergency escape and rescue openings required by Section 1026 are not required.

[F] 403.5 Automatic fire detection. Smoke detection shall be provided in accordance with Section 907.2.12.1.

[F] 403.6 Emergency voice/alarm communication systems. An emergency voice/alarm communication system shall be provided in accordance with Section 907.2.12.2.

[F] 403.7 Fire department communications system. A two-way fire department communications system shall be provided for fire department use in accordance with Section 907.2.12.3.

[F] 403.8 Fire command. A fire command center complying with Section 911 shall be provided in a location approved by the fire department.

403.9 Elevators. Elevator operation and installation shall be in accordance with Chapter 30.

[F] 403.10 Standby power. A standby power system complying with Section 2702 shall be provided for standby power loads specified in Section 403.10.2.

403.10.1 Special requirements for standby power systems. If the standby system is a generator set inside a building, the system shall be located in a separate room enclosed with 2-hour fire barriers constructed in accordance with Section 706 or horizontal assemblies constructed in accordance with Section 711, or both. System supervision with manual start and transfer features shall be provided at the fire command center.

[F] 403.10.2 Standby power loads. The following are classified as standby power loads:

1. Power and lighting for the fire command center required by Section 403.8;
2. Electrically powered fire pumps; and
3. Ventilation and automatic fire detection equipment for smokeproof enclosures.

Standby power shall be provided for elevators in accordance with Sections 1007.4 and 3003.

[F] 403.11 Emergency power systems. An emergency power system complying with Section 2702 shall be provided for emergency power loads specified in Section 403.11.1.

[F] 403.11.1 Emergency power loads. The following are classified as emergency power loads:

1. Exit signs and means of egress illumination required by Chapter 10;
2. Elevator car lighting;
3. Emergency voice/alarm communications systems;
4. Automatic fire detection systems; and
5. Fire alarm systems.

403.12 Stairway door operation. Stairway doors other than the exit discharge doors shall be permitted to be locked from stairway side. Stairway doors that are locked from the stairway side shall be capable of being unlocked simultaneously without unlatching upon a signal from the fire command center.

403.12.1 Stairway communications system. A telephone or other two-way communications system connected to an approved constantly attended station shall be provided at not less than every fifth floor in each required stairway where the doors to the stairway are locked.

403.13 Smokeproof exit enclosures. Every required stairway serving floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall comply with Sections 909.20 and 1020.1.7.

403.14 Seismic considerations. Reserved.

403.15 Smoke control shall be provided in accordance with Section 909.

Exception: I-2 occupancies that comply with Section 407, 419.3.12 and 420.3.16 shall not require smoke control systems in accordance with Section 909.

SECTION 404
ATRIUMS

404.1 General. In other than Group H occupancies, and where permitted by Exception 5 in Section 707.2, the provisions of this section shall apply to buildings or structures containing vertical openings defined herein as "Atriums."

404.1.1 Definition. The following word and term shall, for the purposes of this chapter and as used elsewhere in this code, have the meaning shown herein.

ATRIUM. An opening connecting two or more stories other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. Stories, as used in this definition, do not include balconies within assembly groups or mezzanines that comply with Section 505.

404.2 Use. The atrium floor area is permitted to be used for low and ordinary fire hazard uses where the individual space is protected with an automatic sprinkler system in accordance with Section 903.3.1.1.

[F] 404.3 Automatic sprinkler protection. An approved automatic sprinkler system shall be installed throughout the entire building.

404.4 Smoke control. A smoke control system shall be installed in accordance with Section 909.

Exception: Smoke control is not required for atriums that connect only two stories.

404.5 Enclosure of atriums. Atrium spaces shall be separated from adjacent spaces by a 1-hour fire barrier constructed in accordance with Section 706 or a horizontal assembly constructed in accordance with Section 711, or both.

Exceptions:

1. A glass wall forming a smoke partition where automatic sprinklers are spaced 6 feet (1829 mm) or less along both sides of the separation wall, or on the room side only if there is not a walkway on the atrium side, and between 4 inches and 12 inches (102 mm and 305 mm) away from the glass and designed so that the entire surface of the glass is wet upon activation of the sprinkler system without obstruction. The glass shall be installed in a gasketed frame so that the framing system deflects without breaking (loading) the glass before the sprinkler system operates.
2. A glass-block wall assembly in accordance with Section 2110 and having a $^3/_4$-hour fire protection rating.
3. The adjacent spaces of any three floors of the atrium shall not be required to be separated from the atrium where such spaces are included in the design of the smoke control system.

[F] 404.6 Standby power. Equipment required to provide smoke control shall be connected to a standby power system in accordance with Section 909.11.

404.7 Interior finish. The interior finish of walls and ceilings of the atrium shall not be less than Class B with no reduction in class for sprinkler protection.

404.8 Travel distance. In other than the lowest level of the atrium, where the required means of egress is through the atrium space, the portion of exit access travel distance within the atrium space shall not exceed 200 feet (60 960 mm).

SECTION 405
UNDERGROUND BUILDINGS

405.1 General. The provisions of this section apply to building spaces having a floor level used for human occupancy more than 30 feet (9144 mm) below the lowest level of exit discharge.

Exceptions:

1. One- and two-family dwellings, sprinklered in accordance with Section 903.3.1.3.
2. Parking garages with automatic sprinkler systems in compliance with Section 405.3.
3. Fixed guideway transit systems.
4. Grandstands, bleachers, stadiums, arenas and similar facilities.
5. Where the lowest story is the only story that would qualify the building as an underground building and has an area not exceeding 1,500 square feet (139 m^2) and has an occupant load less than 10.

405.2 Construction requirements. The underground portion of the building shall be of Type I construction.

405.3 Limited access protection. Underground and limited access structures, and all areas and floor levels traversed in traveling to the exit discharge, shall be protected by an

approved, supervised automatic sprinkler system in accordance with Section 903, unless such structures meet one of the following criteria:

1. They have an occupant load of 50 or fewer persons in new underground or limited access portions of the structure.
2. They have an occupant load of 100 or fewer persons in existing underground or limited access portions of the structure.
3. The structure is a single-story underground or limited access structure that is permitted to have a single exit per this code, with a common path of travel not greater than 15 meters (50 ft).

405.4 Compartmentation. Compartmentation shall be in accordance with Sections 405.4.1 through 405.4.3.

405.4.1 Number of compartments. A building having a floor level more than 60 feet (18 288 mm) below the lowest level of exit discharge shall be divided into a minimum of two compartments of approximately equal size. Such compartmentation shall extend through the highest level of exit discharge serving the underground portions of the building and all levels below.

Exception: The lowest story need not be compartmented where the area does not exceed 1,500 square feet (139 m^2) and has an occupant load of less than 10.

405.4.2 Smoke barrier penetration. The compartments shall be separated from each other by a smoke barrier in accordance with Section 709. Penetrations between the two compartments shall be limited to plumbing and electrical piping and conduit that are firestopped in accordance with Section 712. Doorways shall be protected by fire door assemblies that are automatic closing by smoke detection in accordance with Section 715.4.7.3 and are installed in accordance with NFPA 105 and Section 715.4.3. Where provided, each compartment shall have an air supply and an exhaust system independent of the other compartments.

405.4.3 Elevators. Where elevators are provided, each compartment shall have direct access to an elevator. Where an elevator serves more than one compartment, an elevator lobby shall be provided and shall be separated from each compartment by a smoke barrier in accordance with Section 709. Doors shall be gasketed, have a drop sill and be automatic closing by smoke detection in accordance with Section 715.4.7.3.

[F] 405.5 Smoke control system. A smoke control system shall be provided in accordance with Sections 405.5.1 and 405.5.2.

[F] 405.5.1 Control system. A smoke control system is required to control the migration of products of combustion in accordance with Section 909 and the provisions of this section. Smoke control shall restrict movement of smoke to the general area of fire origin and maintain means of egress in a usable condition.

[F] 405.5.2 Compartment smoke control system. Where compartmentation is required, each compartment shall have an independent smoke control system. The system shall be automatically activated and capable of manual operation in accordance with Section 907.2.18.

[F] 405.6 Fire alarm systems. A fire alarm system shall be provided where required by Section 907.2.19.

[F] 405.7 Public address. A public address system shall be provided where required by Section 907.2.19.1.

405.8 Means of egress. Means of egress shall be in accordance with Sections 405.8.1 and 405.8.2.

405.8.1 Number of exits. Each floor level shall be provided with a minimum of two exits. Where compartmentation is required by Section 405.4, each compartment shall have a minimum of one exit and shall also have an exit access doorway into the adjoining compartment.

405.8.2 Smokeproof enclosure. Every required stairway serving floor levels more than 30 feet (9144 mm) below its level of exit discharge shall comply with the requirements for a smokeproof enclosure as provided in Section 1020.1.7.

[F] 405.9 Standby power. A standby power system complying with Section 2702 shall be provided standby power loads specified in Section 405.9.1.

405.9.1 Standby power loads. The following loads are classified as standby power loads.

1. Smoke control system.
2. Ventilation and automatic fire detection equipment for smokeproof enclosures.
3. Fire pumps.

Standby power shall be provided for elevators in accordance with Section 3003.

405.9.2 Pick-up time. The standby power system shall pick up its connected loads within 60 seconds of failure of the normal power supply.

[F] 405.10 Emergency power. An emergency power system complying with Section 2702 shall be provided for emergency power loads specified in Section 405.10.1.

[F] 405.10.1 Emergency power loads. The following loads are classified as emergency power loads:

1. Emergency voice/alarm communications systems.
2. Fire alarm systems.
3. Automatic fire detection systems.
4. Elevator car lighting.
5. Means of egress and exit sign illumination as required by Chapter 10.

[F] 405.11 Standpipe system. The underground building shall be equipped throughout with a standpipe system in accordance with Section 905.

SECTION 406
MOTOR-VEHICLE-RELATED OCCUPANCIES

406.1 Private garages and carports.

406.1.1 Classification. Buildings or parts of buildings classified as Group U occupancies because of the use or charac-

ter of the occupancy shall not exceed 1,000 square feet (93 m^2) in area or one story in height except as provided in Section 406.1.2. Any building or portion thereof that exceeds the limitations specified in this section shall be classified in the occupancy group other than Group U that it most nearly resembles.

406.1.2 Area increase. Group U occupancies used for the storage of private or pleasure-type motor vehicles where no repair work is completed or fuel is dispensed are permitted to be 3,000 square feet (279 m^2) when the following provisions are met:

1. For a mixed occupancy building, the exterior wall and opening protection for the Group U portion of the building shall be as required for the major occupancy of the building. For such a mixed occupancy building, the allowable floor area of the building shall be as permitted for the major occupancy contained therein.
2. For a building containing only a Group U occupancy, the exterior wall shall not be required to have a fire-resistance rating and the area of openings shall not be limited when the fire separation distance is 5 feet (1524 mm) or more.

More than one 3,000-square-foot (279 m^2) Group U occupancy shall be permitted to be in the same building, provided each 3,000-square-foot (279 m^2) area is separated by fire walls complying with Section 705.

406.1.3 Garages and carports. Carports shall be open on at least two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on at least two sides shall be considered a garage and shall comply with the provisions of this section for garages.

Exception: Asphalt surfaces shall be permitted at ground level in carports.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

406.1.4 Separation. Separations shall comply with the following:

1. The private garage shall be separated from the dwelling unit and its attic area by means of a minimum $^1/_2$-inch (12.7 mm) gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than a $^5/_8$-inch Type X gypsum board or equivalent. Door openings between a private garage and the dwelling unit shall be equipped with either solid wood doors or solid or honeycomb core steel doors not less than $1^3/_8$ inches (34.9 mm) thick, or doors in compliance with Section 715.4.3. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Doors shall be self-closing and self-latching.
2. Ducts in a private garage and ducts penetrating the walls or ceilings separating the dwelling unit from the garage shall be constructed of a minimum 0.019-inch (0.48 mm) sheet steel and shall have no openings into the garage.
3. A separation is not required between a Group R-3 and U carport, provided the carport is entirely open on two or more sides and there are not enclosed areas above.

406.2 Parking garages.

406.2.1 Classification. Parking garages shall be classified as either open, as defined in Section 406.3, or enclosed and shall meet the appropriate criteria in Section 406.4. Also see Section 509 for special provisions for parking garages.

406.2.2 Clear height. The clear height of each floor level in vehicle and pedestrian traffic areas shall not be less than 7 feet (2134 mm). Vehicle and pedestrian areas accommodating van-accessible parking shall be in accordance with Chapter 11.

406.2.3 Guards. Guards shall be provided in accordance with Section 1013 at exterior and interior vertical openings on floor and roof areas where vehicles are parked or moved and where the vertical distance to the ground or surface directly below exceeds 30 inches (762 mm).

406.2.4 Vehicle barriers. Parking areas shall be provided with exterior or interior walls or vehicle barriers, except at pedestrian or vehicular accesses, designed in accordance with Section 1607.7. Vehicle barriers not less than 2 feet (607 mm) high shall be placed at the end of drive lanes, and at the end of parking spaces where the difference in adjacent floor elevation is greater than 1 foot (305 mm).

Exception: Vehicle storage compartments in a mechanical access parking garage.

406.2.5 Ramps. Vehicle ramps shall not be considered as required exits unless pedestrian facilities are provided. Vehicle ramps that are utilized for vertical circulation as well as for parking shall not exceed a slope of 1:15 (6.67 percent).

406.2.6 Floor surface. Parking surfaces shall be of concrete or similar noncombustible and nonabsorbent materials.

Exception: Asphalt parking surfaces are permitted at ground level.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

406.2.7 Mixed separation. Parking garages shall be separated from other occupancies in accordance with Section 508.3.

406.2.8 Special hazards. Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation.

Exception: A single door shall be allowed provided the sources of ignition in the appliance are at least 18 inches (457 mm) above the floor.

406.2.9 Attached to rooms. Openings from a parking garage directly into a room used for sleeping purposes shall not be permitted.

406.3 Open parking garages.

406.3.1 Scope. Except where specific provisions are made in the following subsections, other requirements of this code shall apply.

406.3.2 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

MECHANICAL-ACCESS OPEN PARKING GARAGES. Open parking garages employing parking machines, lifts, elevators or other mechanical devices for vehicles moving from and to street level and in which public occupancy is prohibited above the street level.

OPEN PARKING GARAGE. A structure or portion of a structure with the openings as described in Section 406.3.3.1 on two or more sides that is used for the parking or storage of private motor vehicles as described in Section 406.3.4.

RAMP-ACCESS OPEN PARKING GARAGES. Open parking garages employing a series of continuously rising floors or a series of interconnecting ramps between floors permitting the movement of vehicles under their own power from and to the street level.

406.3.3 Construction. Open parking garages shall be of Type I, II or IV construction. Open parking garages shall meet the design requirements of Chapter 16. For vehicle barriers, see Section 406.2.4.

406.3.3.1 Openings. For natural ventilation purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in exterior walls on a tier must be at least 20 percent of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural ventilation shall constitute a minimum of 40 percent of the perimeter of the tier. Interior walls shall be at least 20 percent open with uniformly distributed openings.

Exception: Openings are not required to be distributed over 40 percent of the building perimeter where the required openings are uniformly distributed over two opposing sides of the building.

406.3.4 Uses. Mixed uses shall be allowed in the same building as an open parking garage subject to the provisions of Sections 508.3, 402.7.1, 406.3.13, 509.3, 509.4 and 509.7.

406.3.5 Area and height. Area and height of open parking garages shall be limited as set forth in Chapter 5 for Group S-2 occupancies and as further provided for in Section 508.3.

406.3.5.1 Single use. When the open parking garage is used exclusively for the parking or storage of private motor vehicles, with no other uses in the building, the area and height shall be permitted to comply with Table 406.3.5, along with increases allowed by Section 406.3.6.

Exception: The grade-level tier is permitted to contain an office, waiting and toilet rooms having a total combined area of not more than 1,000 square feet (93 m^2). Such area need not be separated from the open parking garage.

In open parking garages having a spiral or sloping floor, the horizontal projection of the structure at any cross section shall not exceed the allowable area per parking tier. In the case of an open parking garage having a continuous spiral floor, each 9 feet 6 inches (2896 mm) of height, or portion thereof, shall be considered a tier.

The clear height of a parking tier shall not be less than 7 feet (2134 mm), except that a lower clear height is permitted in mechanical-access open parking garages where approved by the building official.

406.3.6 Area and height increases. The allowable area and height of open parking garages shall be increased in accordance with the provisions of this section. Garages with sides open on three-fourths of the building's perimeter are permitted to be increased by 25 percent in area and one tier in height. Garages with sides open around the entire building's perimeter are permitted to be increased by 50 percent in area and one tier in height. For a side to be considered open under the above provisions, the total area of openings along the side shall not be less than 50 percent of the interior area of the side at each tier and such openings shall be equally distributed along the length of the tier.

TABLE 406.3.5
OPEN PARKING GARAGES AREA AND HEIGHT

TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	HEIGHT (in tiers)		
			Mechanical access	
			Automatic sprinkler system	
		Ramp access	No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	50,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

For SI: 1 square foot = 0.0929 m^2.

Allowable tier areas in Table 406.3.5 shall be increased for open parking garages constructed to heights less than the table maximum. The gross tier area of the garage shall not exceed that permitted for the higher structure. At least three sides of each such larger tier shall have continuous horizontal openings not less than 30 inches (762 mm) in clear height extending for at least 80 percent of the length of the sides and no part of such larger tier shall be more than 200 feet (60 960 mm) horizontally from such an opening. In addition, each such opening shall face a street or yard accessible to a street with a width of at least 30 feet (9144 mm) for the full length of the opening, and standpipes shall be provided in each such tier.

Open parking garages of Type II construction, with all sides open, shall be unlimited in allowable area where the height does not exceed 75 feet (22 860 mm). For a side to be considered open, the total area of openings along the side shall not be less than 50 percent of the interior area of the side at each tier and such openings shall be equally distributed along the length of the tier. All portions of tiers shall be within 200 feet (60 960 mm) horizontally from such openings or other natural ventilation openings as defined in Section 406.3.3.1. These openings shall be permitted to be provided in courts with a minimum width of 30 feet (9144 mm) for the full width of the openings.

406.3.7 Fire separation distance. Exterior walls and openings in exterior walls shall comply with Tables 601 and 602. The distance to an adjacent lot line shall be determined in accordance with Table 602 and Section 704.

406.3.8 Means of egress. Where persons other than parking attendants are permitted, open parking garages shall meet the means of egress requirements of Chapter 10. Where no persons other than parking attendants are permitted, there shall not be less than two 36-inch-wide (914 mm) exit stairways. Lifts shall be permitted to be installed for use of employees only, provided they are completely enclosed by noncombustible materials.

406.3.9 Standpipes. Standpipes shall be installed where required by the provisions of Chapter 9.

406.3.10 Sprinkler systems. Where required by other provisions of this code, automatic sprinkler systems and standpipes shall be installed in accordance with the provisions of Chapter 9.

406.3.11 Enclosure of vertical openings. Enclosure shall not be required for vertical openings except as specified in Section 406.3.8.

406.3.12 Ventilation. Ventilation, other than the percentage of openings specified in Section 406.3.3.1, shall not be required.

406.3.13 Prohibitions. The following uses and alterations are not permitted:

1. Vehicle repair work.
2. Parking of buses, trucks and similar vehicles.
3. Partial or complete closing of required openings in exterior walls by tarpaulins or any other means.
4. Dispensing of fuel.

406.4 Enclosed parking garages.

406.4.1 Heights and areas. Enclosed vehicle parking garages and portions thereof that do not meet the definition of open parking garages shall be limited to the allowable heights and areas specified in Table 503 as modified by Sections 504, 506 and 507. Roof parking is permitted.

406.4.2 Ventilation. A mechanical ventilation system shall be provided in accordance with the *Florida Building Code, Mechanical.*

406.5 Motor fuel-dispensing facilities.

406.5.1 Construction. Motor fuel-dispensing facilities shall be constructed in accordance with the *Florida Fire Prevention Code* and this section.

406.5.2 Canopies. Canopies under which fuels are dispensed shall have a clear, unobstructed height of not less than 13 feet 6 inches (4115 mm) to the lowest projecting element in the vehicle drive-through area. Canopies and their supports over pumps shall be of noncombustible materials, fire-retardant-treated wood complying with Chapter 23, wood of Type IV sizes or of construction providing 1-hour fire resistance. Combustible materials used in or on a canopy shall comply with one of the following:

1. Shielded from the pumps by a noncombustible element of the canopy, or wood of Type IV sizes;
2. Plastics covered by aluminum facing having a minimum thickness of 0.010 inch (0.30 mm) or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm). The plastic shall have a flame spread index of 25 or less and a smoke-developed index of 450 or less when tested in the form intended for use in accordance with ASTM E 84 and a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929; or
3. Panels constructed of light-transmitting plastic materials shall be permitted to be installed in canopies erected over motor vehicle fuel-dispensing station fuel dispensers, provided the panels are located at least 10 feet (3048 mm) from any building on the same lot and face yards or streets not less than 40 feet (12 192 mm) in width on the other sides. The aggregate areas of plastics shall not exceed 1,000 square feet (93 m^2). The maximum area of any individual panel shall not exceed 100 square feet (9.3 m^2).

406.5.2.1 Canopies used to support gaseous hydrogen systems. Canopies that are used to shelter dispensing operations where flammable compressed gases are located on the roof of the canopy shall be in accordance with the following:

1. The canopy shall meet or exceed Type I construction requirements.
2. Operations located under canopies shall be limited to refueling only.
3. The canopy shall be constructed in a manner that prevents the accumulation of hydrogen gas.

406.5.3 Pumps or other dispensing devices installed above grade shall be mounted on a concrete foundation and protected against vehicle damage by mounting on a concrete island or other approved collision protection. Subsurface pumps shall be installed in accordance with approved standards.

406.6 Repair garages.

406.6.1 General. Repair garages shall be constructed in accordance with the *Florida Fire Prevention Code* and this section. This occupancy shall not include motor fuel-dispensing facilities, as regulated in Section 406.5.

406.6.2 Mixed uses. Mixed uses shall be allowed in the same building as a repair garage subject to the provisions of Section 508.3.

406.6.3 Ventilation. Repair garages shall be mechanically ventilated in accordance with the *Florida Building Code, Mechanical*. The ventilation system shall be controlled at the entrance to the garage.

406.6.4 Floor surface. Repair garage floors shall be of concrete or similar noncombustible and nonabsorbent materials.

Exception: Slip-resistant, nonabsorbent, interior floor finishes having a critical radiant flux not more than 0.45 W/cm^2, as determined by NFPA 253, shall be permitted.

406.6.5 Heating equipment. Heating equipment shall be installed in accordance with the *Florida Building Code, Mechanical*.

[F] 406.6.6 Gas detection system. Repair garages used for repair of vehicles fueled by nonodorized gases, such as hydrogen and nonodorized LNG, shall be provided with an approved flammable gas-detection system.

[F] 406.6.6.1 System design. The flammable gas-detection system shall be calibrated to the types of fuels or gases used by vehicles to be repaired. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the lower explosive limit. Gas detection shall also be provided in lubrication or chassis repair pits of garages used for repairing nonodorized LNG-fueled vehicles.

[F] 406.6.6.2 Operation. Activation of the gas detection system shall result in all of the following:

1. Initiation of distinct audible and visual alarm signals in the repair garage.
2. Deactivation of all heating systems located in the repair garage.
3. Activation of the mechanical ventilation system, where the system is interlocked with gas detection.

[F] 406.6.6.3 Failure of the gas detection system. Failure of the gas detection system shall result in the deactivation of the heating system, activation of the mechanical ventilation system when the system is interlocked with the gas detection system and cause a trouble signal to sound in an approved location.

SECTION 407
GROUP I-2

407.1 General. Occupancies in Group I-2 shall comply with the provisions of this section and other applicable provisions of this code.

407.2 Corridors. Corridors in occupancies in Group I-2 shall be continuous to the exits and separated from other areas in accordance with Section 407.3 except spaces conforming to Sections 407.2.1 through 407.2.4.

407.2.1 Spaces of unlimited area. Waiting areas and similar spaces constructed as required for corridors shall be permitted to be open to a corridor, only where all of the following criteria are met:

1. The spaces are not occupied for patient sleeping units, treatment rooms, hazardous or incidental use areas as defined in Section 508.2.
2. The open space is protected by an automatic fire detection system installed in accordance with Section 907.
3. The corridors onto which the spaces open, in the same smoke compartment, are protected by an automatic fire detection system installed in accordance with Section 907, or the smoke compartment in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
4. The space is arranged so as not to obstruct access to the required exits.

407.2.2 Nurses' stations. Spaces for doctors' and nurses' charting, communications and related clerical areas shall be permitted to be open to the corridor, when such spaces are constructed as required for corridors.

407.2.3 Mental health treatment areas. Areas wherein mental health patients who are not capable of self-preservation are housed, or group meeting or multipurpose therapeutic spaces other than incidental use areas as defined in Section 508.2, under continuous supervision by facility staff, shall be permitted to be open to the corridor, where the following criteria are met:

1. Each area does not exceed 1,500 square feet (140 m^2).
2. The area is located to permit supervision by the facility staff.
3. The area is arranged so as not to obstruct any access to the required exits.
4. The area is equipped with an automatic fire detection system installed in accordance with Section 907.2.
5. Not more than one such space is permitted in any one smoke compartment.
6. The walls and ceilings of the space are constructed as required for corridors.

407.2.4 Gift shops. Gift shops less than 500 square feet (46.5 m^2) in area shall be permitted to be open to the corridor provided the gift shop and storage areas are fully

sprinklered and storage areas are protected in accordance with Section 508.2.

407.3 Corridor walls. Corridor walls shall be constructed as smoke partitions in accordance with Section 710.

407.3.1 Corridor doors. Corridor doors, other than those in a wall required to be rated by Section 508.2 or for the enclosure of a vertical opening or an exit, shall not have a required fire protection rating and shall not be required to be equipped with self-closing or automatic-closing devices, but shall provide an effective barrier to limit the transfer of smoke and shall be equipped with positive latching. Roller latches are not permitted. Other doors shall conform to Section 715.4.

407.3.2 Locking devices. Locking devices that restrict access to the patient room from the corridor, and that are operable only by staff from the corridor side, shall not restrict the means of egress from the patient room except for patient rooms in mental health facilities.

407.4 Smoke barriers. Smoke barriers shall be provided to subdivide every story used by patients for sleeping or treatment and to divide other stories with an occupant load of 50 or more persons, into at least two smoke compartments. Such stories shall be divided into smoke compartments with an area of not more than 22,500 square feet (2092 m^2) and the travel distance from any point in a smoke compartment to a smoke barrier door shall not exceed 200 feet (60 960 mm). The smoke barrier shall be in accordance with Section 709.

407.4.1 Refuge area. At least 30 net square feet (2.8 m^2) per patient shall be provided within the aggregate area of corridors, patient rooms, treatment rooms, lounge or dining areas and other low-hazard areas on each side of each smoke barrier. On floors not housing patients confined to a bed or litter, at least 6 net square feet (0.56 m^2) per occupant shall be provided on each side of each smoke barrier for the total number of occupants in adjoining smoke compartments.

407.4.2 Independent egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated.

[F] 407.5 Automatic sprinkler system. Smoke compartments containing patient sleeping units shall be equipped throughout with an automatic fire sprinkler system in accordance with Section 903.3.1.1. The smoke compartments shall be equipped with approved quick-response or residential sprinklers in accordance with Section 903.3.2.

[F] 407.6 Automatic fire detection. Corridors in nursing homes (both intermediate care and skilled nursing facilities), detoxification facilities and spaces permitted to be open to the corridors by Section 407.2 shall be equipped with an automatic fire detection system. Hospitals shall be equipped with smoke detection as required in Section 407.2.

Exceptions:

1. Corridor smoke detection is not required where patient sleeping units are provided with smoke detectors that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each patient sleeping unit and an audible and visual alarm at the nursing station attending each unit.
2. Corridor smoke detection is not required where patient sleeping unit doors are equipped with automatic door-closing devices with integral smoke detectors on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.

407.7 Secured yards. Grounds are permitted to be fenced and gates therein are permitted to be equipped with locks, provided that safe dispersal areas having 30 net square feet (2.8 m^2) for bed and litter patients and 6 net square feet (0.56 m^2) for ambulatory patients and other occupants are located between the building and the fence. Such provided safe dispersal areas shall not be located less than 50 feet (15 240 mm) from the building they serve.

SECTION 408
GROUP I-3

408.1 General. Occupancies in Group I-3 shall comply with the provisions of this section and other applicable provisions of this code (see Section 308.4).

408.2 Mixed occupancies. Portions of buildings with an occupancy in Group I-3 that are classified as a different occupancy shall meet the applicable requirements of this code for such occupancies. Where security operations necessitate the locking of required means of egress, provisions shall be made for the release of occupants at all times.

Means of egress from detention and correctional occupancies that traverse other use areas shall, as a minimum, conform to requirements for detention and correctional occupancies.

Exception: It is permissible to exit through a horizontal exit into other contiguous occupancies that do not conform to detention and correctional occupancy egress provisions but that do comply with requirements set forth in the appropriate occupancy, as long as the occupancy is not a high-hazard use.

408.3 Means of egress. Except as modified or as provided for in this section, the provisions of Chapter 10 shall apply.

408.3.1 Door width. Doors to resident sleeping units shall have a clear width of not less than 28 inches (711 mm).

408.3.2 Sliding doors. Where doors in a means of egress are of the horizontal-sliding type, the force to slide the door to its fully open position shall not exceed 50 pounds (220 N) with a perpendicular force against the door of 50 pounds (220 N).

408.3.3 Spiral stairs. Spiral stairs that conform to the requirements of Section 1009.8 are permitted for access to and between staff locations.

408.3.4 Exit discharge. Exits are permitted to discharge into a fenced or walled courtyard. Enclosed yards or courts shall be of a size to accommodate all occupants, a minimum of 50 feet (15 240 mm) from the building with a net area of 15 square feet (1.4 m^2) per person.

408.3.5 Sallyports. A sallyport shall be permitted in a means of egress where there are provisions for continuous

and unobstructed passage through the sallyport during an emergency egress condition.

408.3.6 Exit enclosures. One of the required exit enclosures in each building shall be permitted to have glazing installed in doors and interior walls at each landing level providing access to the enclosure, provided that the following conditions are met:

1. The exit enclosure shall not serve more than four floor levels.
2. Exit doors shall not be less than $^3/_4$-hour fire door assemblies complying with Section 715.4
3. The total area of glazing at each floor level shall not exceed 5,000 square inches (3 m^2) and individual panels of glazing shall not exceed 1,296 square inches (0.84 m^2).
4. The glazing shall be protected on both sides by an automatic fire sprinkler system. The sprinkler system shall be designed to wet completely the entire surface of any glazing affected by fire when actuated.
5. The glazing shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler system operates.
6. Obstructions, such as curtain rods, drapery traverse rods, curtains, drapes or similar materials shall not be installed between the automatic sprinklers and the glazing.

408.4 Locks. Egress doors are permitted to be locked in accordance with the applicable use condition. Doors from an area of refuge to the exterior are permitted to be locked with a key in lieu of locking methods described in Section 408.4.1. The keys to unlock the exterior doors shall be available at all times and the locks shall be operable from both sides of the door.

408.4.1 Remote release. Remote release of locks on doors in a means of egress shall be provided with reliable means of operation, remote from the resident living areas, to release locks on all required doors. In Occupancy Conditions 3 or 4, the arrangement, accessibility and security of the release mechanism(s) required for egress shall be such that with the minimum available staff at any time, the lock mechanisms are capable of being released within 2 minutes.

Exception: Provisions for remote locking and unlocking of occupied rooms in Occupancy Condition 4 are not required provided that not more than 10 locks are necessary to be unlocked in order to move occupants from one smoke compartment to a refuge area within 3 minutes. The opening of necessary locks shall be accomplished with not more than two separate keys.

408.4.2 Power-operated doors and locks. Power-operated sliding doors or power-operated locks for swinging doors shall be operable by a manual release mechanism at the door, and either emergency power or a remote mechanical operating release shall be provided.

Exception: Emergency power is not required in facilities with 10 locks or less complying with the exception to Section 408.4.1.

408.4.3 Redundant operation. Remote release, mechanically operated sliding doors or remote release, mechanically operated locks shall be provided with a mechanically operated release mechanism at each door, or shall be provided with a redundant remote release control.

408.4.4 Relock capability. Doors remotely unlocked under emergency conditions shall not automatically relock when closed unless specific action is taken at the remote location to enable doors to relock.

408.5 Vertical openings. Vertical openings shall be enclosed in accordance with Section 707.

Exception: A floor opening between floor levels of residential housing areas is permitted without enclosure protection between the levels, provided that both of the following conditions are met:

1. The entire normally occupied areas so interconnected are open and unobstructed so as to enable observation of the areas by supervisory personnel.
2. Means of egress capacity is sufficient to provide simultaneous egress for all occupants from all interconnected levels and areas.

The height difference between the highest and lowest finished floor levels shall not exceed 23 feet (7010 mm). Each story, considered separately, has at least one-half of its individual required means of egress capacity provided by exits leading directly out of that story without traversing another story within the interconnected area.

408.6 Smoke barrier. Occupancies in Group I-3 shall have smoke barriers complying with Section 709 to divide every story occupied by residents for sleeping, or any other story having an occupant load of 50 or more persons, into at least two smoke compartments.

Exception: Spaces having a direct exit to one of the following, provided that the locking arrangement of the doors involved complies with the requirements for doors at the smoke barrier for the use condition involved:

1. A public way.
2. A building separated from the resident housing area by a 2-hour fire-resistance-rated assembly or 50 feet (15 240 mm) of open space.
3. A secured yard or court having a holding space 50 feet (15 240 mm) from the housing area that provides 6 square feet (0.56 m^2) or more of refuge area per occupant, including residents, staff and visitors.

408.6.1 Smoke compartments. The maximum number of residents in any smoke compartment shall be 200. The travel distance to a door in a smoke barrier from any room door required as exit access shall not exceed 150 feet (45 720 mm). The travel distance to a door in a smoke barrier from any point in a room shall not exceed 200 feet (60 960 mm).

408.6.2 Refuge area. At least 6 net square feet (0.56 m^2) per occupant shall be provided on each side of each smoke barrier for the total number of occupants in adjoining smoke compartments. This space shall be readily available wher-

ever the occupants are moved across the smoke barrier in a fire emergency.

408.6.3 Independent egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originates.

408.7 Subdivision of resident housing areas. Sleeping areas and any contiguous day room, group activity space or other common spaces where residents are housed shall be separated from other spaces in accordance with Sections 408.7.1 through 408.7.4.

408.7.1 Occupancy Conditions 3 and 4. Each sleeping area in Occupancy Conditions 3 and 4 shall be separated from the adjacent common spaces by a smoke-tight partition where the travel distance from the sleeping area through the common space to the corridor exceeds 50 feet (15 240 mm).

408.7.2 Occupancy Condition 5. Each sleeping area in Occupancy Condition 5 shall be separated from adjacent sleeping areas, corridors and common spaces by a smoke-tight partition. Additionally, common spaces shall be separated from the corridor by a smoke-tight partition.

408.7.3 Openings in room face. The aggregate area of openings in a solid sleeping room face in Occupancy Conditions 2, 3, 4 and 5 shall not exceed 120 square inches (77 419 mm^2). The aggregate area shall include all openings including door undercuts, food passes and grilles. Openings shall be not more than 36 inches (914 mm) above the floor. In Occupancy Condition 5, the openings shall be closeable from the room side.

408.7.4 Smoke-tight doors. Doors in openings in partitions required to be smoke tight by Section 408.7 shall be substantial doors, of construction that will resist the passage of smoke. Latches and door closures are not required on cell doors.

408.8 Windowless buildings. For the purposes of this section, a windowless building or portion of a building is one with nonopenable windows, windows not readily breakable or without windows. Windowless buildings shall be provided with an engineered smoke control system to provide ventilation (mechanical or natural) in accordance with Section 909 for each windowless smoke compartment.

SECTION 409
MOTION PICTURE PROJECTION ROOMS

409.1 General. The provisions of this section shall apply to rooms in which ribbon-type cellulose acetate or other safety film is utilized in conjunction with electric arc, xenon or other light-source projection equipment that develops hazardous gases, dust or radiation. Where cellulose nitrate film is utilized or stored, such rooms shall comply with NFPA 40.

409.1.1 Projection room required. Every motion picture machine projecting film as mentioned within the scope of this section shall be enclosed in a projection room. Appurtenant electrical equipment, such as rheostats, transformers and generators, shall be within the projection room or in an adjacent room of equivalent construction.

409.2 Construction of projection rooms. Every projection room shall be of permanent construction consistent with the construction requirements for the type of building in which the projection room is located. Openings are not required to be protected.

The room shall have a floor area of not less than 80 square feet (7.44 m^2) for a single machine and at least 40 square feet (3.7 m^2) for each additional machine. Each motion picture projector, floodlight, spotlight or similar piece of equipment shall have a clear working space of not less than 30 inches by 30 inches (762 mm by 762 mm) on each side and at the rear thereof, but only one such space shall be required between two adjacent projectors. The projection room and the rooms appurtenant thereto shall have a ceiling height of not less than 7 feet 6 inches (2286 mm). The aggregate of openings for projection equipment shall not exceed 25 percent of the area of the wall between the projection room and the auditorium. Openings shall be provided with glass or other approved material, so as to close completely the opening.

409.3 Projection room and equipment ventilation. Ventilation shall be provided in accordance with the *Florida Building Code, Mechanical*.

409.3.1 Supply air. Each projection room shall be provided with adequate air supply inlets so arranged as to provide well-distributed air throughout the room. Air inlet ducts shall provide an amount of air equivalent to the amount of air being exhausted by projection equipment. Air is permitted to be taken from the outside; from adjacent spaces within the building, provided the volume and infiltration rate is sufficient; or from the building air-conditioning system, provided it is so arranged as to provide sufficient air when other systems are not in operation.

409.3.2 Exhaust air. Projection rooms are permitted to be exhausted through the lamp exhaust system. The lamp exhaust system shall be positively interconnected with the lamp so that the lamp will not operate unless there is the required airflow. Exhaust air ducts shall terminate at the exterior of the building in such a location that the exhaust air cannot be readily recirculated into any air supply system. The projection room ventilation system is permitted to also serve appurtenant rooms, such as the generator and rewind rooms.

409.3.3 Projection machines. Each projection machine shall be provided with an exhaust duct that will draw air from each lamp and exhaust it directly to the outside of the building. The lamp exhaust is permitted to serve to exhaust air from the projection room to provide room air circulation. Such ducts shall be of rigid materials, except for a flexible connector approved for the purpose. The projection lamp or projection room exhaust system, or both, is permitted to be combined but shall not be interconnected with any other exhaust or return system, or both, within the building.

409.4 Lighting control. Provisions shall be made for control of the auditorium lighting and the means of egress lighting systems of theaters from inside the projection room and from at least one other convenient point in the building.

409.5 Miscellaneous equipment. Each projection room shall be provided with rewind and film storage facilities.

SECTION 410
STAGES AND PLATFORMS

410.1 Applicability. The provisions of this section shall apply to all parts of buildings and structures that contain stages or platforms and similar appurtenances as herein defined.

410.2 Definitions. The following words and terms shall, for the purposes of this section and as used elsewhere in this code, have the meanings shown herein.

FLY GALLERY. A raised floor area above a stage from which the movement of scenery and operation of other stage effects are controlled.

GRIDIRON. The structural framing over a stage supporting equipment for hanging or flying scenery and other stage effects.

PINRAIL. A rail on or above a stage through which belaying pins are inserted and to which lines are fastened.

PLATFORM. A raised area within a building used for worship, the presentation of music, plays or other entertainment; the head table for special guests; the raised area for lecturers and speakers; boxing and wrestling rings; theater-in-the-round stages; and similar purposes wherein there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days.

PROSCENIUM WALL. The wall that separates the stage from the auditorium or assembly seating area.

STAGE. A space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound.

410.3 Stages. Stage construction shall comply with Sections 410.3.1 through 410.3.7.

410.3.1 Stage construction. Stages shall be constructed of materials as required for floors for the type of construction of the building in which such stages are located.

Exceptions:

1. Stages of Type IIB or IV construction with a nominal 2-inch (51 mm) wood deck, provided that the stage is separated from other areas in accordance with Section 410.3.4.
2. In buildings of Type IIA, IIIA and VA construction, a fire-resistance-rated floor is not required, provided the space below the stage is equipped with an automatic fire-extinguishing system in accordance with Section 903 or 904.
3. In all types of construction, the finished floor shall be constructed of wood or approved noncombustible materials. Openings through stage floors shall be equipped with tight-fitting, solid wood trap doors *with approved safety locks.*

410.3.1.1 Stage height and area. Stage areas shall be measured to include the entire performance area and adjacent backstage and support areas not separated from the performance area by fire-resistance-rated construction. Stage height shall be measured from the lowest point on the stage floor to the highest point of the roof or floor deck above the stage.

410.3.2 Galleries, gridirons, catwalks and pinrails. Beams designed only for the attachment of portable or fixed theater equipment, gridirons, galleries and catwalks shall be constructed of approved materials consistent with the requirements for the type of construction of the building; and a fire-resistance rating shall not be required. These areas shall not be considered to be floors, stories, mezzanines or levels in applying this code.

Exception: Floors of fly galleries and catwalks shall be constructed of any approved material.

410.3.3 Exterior stage doors. Where protection of openings is required, exterior exit doors shall be protected with fire door assemblies that comply with Section 715. Exterior openings that are located on the stage for means of egress or loading and unloading purposes, and that are likely to be open during occupancy of the theater, shall be constructed with vestibules to prevent air drafts into the auditorium.

410.3.4 Proscenium wall. Where the stage height is greater than 50 feet (15 240 mm), all portions of the stage shall be completely separated from the seating area by a proscenium wall with not less than a 2-hour fire-resistance rating extending continuously from the foundation to the roof.

410.3.5 Proscenium curtain. Where a proscenium wall is required to have a fire-resistance rating, the stage opening shall be provided with a fire curtain of approved material or an approved water curtain complying with Section 903.3.1.1. The fire curtain shall be designed and installed to intercept hot gases, flames and smoke and to prevent a glow from a severe fire on the stage from showing on the auditorium side for a period of 20 minutes. The closing of the fire curtain from the full open position shall be accomplished in less than 30 seconds, with the last 8 feet (2438 mm) of travel requiring 5 or more seconds for full closure.

410.3.5.1 Activation. The curtain shall be activated by rate-of-rise heat detection installed in accordance with Section 907.10 operating at a rate of temperature rise of 15 to 20°F per minute (8 to 11°C per minute), and by an auxiliary manual control.

410.3.5.2 Fire test. A sample curtain with a minimum of two vertical seams shall be subjected to the standard fire test specified in ASTM E 119 for a period of 30 minutes. The curtain shall overlap the furnace edges by an amount that is appropriate to seal the top and sides. The curtain shall have a bottom pocket containing a minimum of 4 pounds per linear foot (5.9 kg/m) of batten. The exposed surface of the curtain shall not glow, and flame or smoke shall not penetrate the curtain during the test period. Unexposed surface temperature and hose stream test requirements are not applicable to the proscenium fire safety curtain test.

410.3.5.3 Smoke test. Curtain fabrics shall have a smoke-developed rating of 25 or less when tested in accordance with ASTM E 84.

410.3.5.4 Tests. The completed proscenium curtain shall be subjected to operating tests prior to the issuance of a certificate of occupancy.

410.3.6 Scenery. Combustible materials used in sets and scenery shall meet the fire propagation performance criteria of NFPA 701, in accordance with Section 806 and the *Florida Fire Prevention Code*. Foam plastics and materials containing foam plastics shall comply with Section 2603 and the *Florida Fire Prevention Code*.

410.3.7 Stage ventilation. Emergency ventilation shall be provided for stages larger than 1,000 square feet (93 m^2) in floor area, or with a stage height greater than 50 feet (15 240 mm). Such ventilation shall comply with Section 410.3.7.1 or 410.3.7.2.

410.3.7.1 Roof vents. Two or more vents constructed to open automatically by approved heat-activated devices and with an aggregate clear opening area of not less than 5 percent of the area of the stage shall be located near the center and above the highest part of the stage area. Supplemental means shall be provided for manual operation of the ventilator. Curbs shall be provided as required for skylights in Section 2610.2. Vents shall be labeled.

[F] 410.3.7.2 Smoke control. Smoke control in accordance with Section 909 shall be provided to maintain the smoke layer interface not less than 6 feet (1829 mm) above the highest level of the assembly seating or above the top of the proscenium opening where a proscenium wall is provided in compliance with Section 410.3.4.

410.4 Platform construction. Permanent platforms shall be constructed of materials as required for the type of construction of the building in which the permanent platform is located. Permanent platforms are permitted to be constructed of fire-retardant-treated wood for Type I, II, and IV construction where the platforms are not more than 30 inches (762 mm) above the main floor, and not more than one-third of the room floor area and not more than 3,000 square feet (279 m^2) in area. Where the space beneath the permanent platform is used for storage or any other purpose other than equipment, wiring or plumbing, the floor construction shall not be less than 1-hour fire-resistance-rated construction. Where the space beneath the permanent platform is used only for equipment, wiring or plumbing, the underside of the permanent platform need not be protected.

410.4.1 Temporary platforms. Platforms installed for a period of not more than 30 days are permitted to be constructed of any materials permitted by the code. The space between the floor and the platform above shall only be used for plumbing and electrical wiring to platform equipment.

410.5 Dressing and appurtenant rooms. Dressing and appurtenant rooms shall comply with Sections 410.5.1 through 410.5.3.

410.5.1 Separation from stage. Where the stage height is greater than 50 feet (15 240 mm), the stage shall be separated from dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage and other parts of the building by a fire barrier with not less than a 2-hour fire-resistance rating with approved opening protectives. For stage heights of 50 feet (15 240 mm) or less, the required stage separation shall be a fire barrier with not less than a 1-hour fire-resistance rating with approved opening protectives.

410.5.2 Separation from each other. Dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage shall be separated from each other by fire barriers with not less than a 1-hour fire-resistance rating with approved opening protectives.

410.5.3 Stage exits. At least one approved means of egress shall be provided from each side of the stage and from each side of the space under the stage. At least one means of escape shall be provided from each fly gallery and from the gridiron. A steel ladder, alternating tread stairway or spiral stairway is permitted to be provided from the gridiron to a scuttle in the stage roof.

[F] 410.6 Automatic sprinkler system. Stages shall be equipped with an automatic fire-extinguishing system in accordance with Chapter 9. Sprinklers shall be installed under the roof and gridiron and under all catwalks and galleries over the stage. Sprinklers shall be installed in dressing rooms, performer lounges, shops and storerooms accessory to such stages.

Exceptions:

1. Sprinklers are not required under stage areas less than 4 feet (1219 mm) in clear height that are utilized exclusively for storage of tables and chairs, provided the concealed space is separated from the adjacent spaces by not less than $^5/_8$-inch (15.9 mm) Type X gypsum board.
2. Sprinklers are not required for stages 1,000 square feet (93 m^2) or less in area and 50 feet (15 240 mm) or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs and a single backdrop.
3. Sprinklers are not required within portable orchestra enclosures on stages.

[F] 410.7 Standpipes. Standpipe systems shall be provided in accordance with Section 905.

SECTION 411
SPECIAL AMUSEMENT BUILDINGS

411.1 General. Special amusement buildings, regardless of occupant load, shall meet the requirements for assembly occupancies in addition to the requirements of Section 411.

Exception: Special amusement buildings that are multilevel play structures not more than 120 inches (3050 mm) in height and have aggregate horizontal projections not exceeding 160 square feet (15 m^2).

411.2 Definition. The following word and term shall, for the purpose of this section and as used elsewhere in this code, have the meaning shown herein.

SPECIAL AMUSEMENT BUILDING. A special amusement building is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and that contains a device or system that conveys passengers or provides a walkway along, around or over a course in any direction so arranged that the means of egress path is not readily apparent due to visual or audio distractions or is intentionally confounded or is not readily available because of the nature of the attraction or mode of conveyance through the building or structure.

411.3 Automatic fire detection. Where the nature of the special amusement buildings is such that it operates in reduced lighting levels, special amusement buildings shall be equipped with an automatic fire detection system in accordance with Section 907.

411.4 Automatic sprinkler system. Special amusement buildings shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where the special amusement building is temporary, the sprinkler water supply shall be of an approved temporary means.

Exception: Automatic fire sprinklers are not required where special amusement buildings or structures do not exceed 120 inches (3050 mm) in height and do not exceed 160 square feet (15 m^2) in aggregate horizontal projection.

[F] 411.5 Alarm. Actuation of a single smoke detector, the automatic sprinkler system or other automatic fire detection device shall immediately sound an alarm at the building at a constantly attended location from which emergency action can be initiated including the capability of manual initiation of requirements in Section 907.2.11.2.

[F] 411.6 Emergency voice/alarm communications system. An emergency voice/alarm communications system shall be provided in accordance with Sections 907.2.11 and 907.2.12.2, which is also permitted to serve as a public address system and shall be audible throughout the entire special amusement building.

411.7 Exit marking. Exit signs shall be installed at the required exit or exit access doorways of amusement buildings. Approved directional exit markings shall also be provided. Where mirrors, mazes or other designs are utilized that disguise the path of egress travel such that they are not apparent, approved low-level exit signs and directional path markings shall be provided and located not more than 8 inches (203 mm) above the walking surface and on or near the path of egress travel. Such markings shall become visible in an emergency. The directional exit marking shall be activated by the automatic fire detection system and the automatic sprinkler system in accordance with Section 907.2.11.2.

411.8 Interior finish. The interior finish shall be Class A in accordance with Section 803.1.

SECTION 412
AIRCRAFT-RELATED OCCUPANCIES

412.1 Airport traffic control towers.

412.1.1 General. The provisions of this section shall apply to airport traffic control towers not exceeding 1,500 square feet (140 m^2) per floor occupied only for the following uses:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.

412.1.2 Type of construction. Airport traffic control towers shall be constructed to comply with the height and area limitations of Table 412.1.2.

TABLE 412.1.2
HEIGHT AND AREA LIMITATIONS FOR AIRPORT TRAFFIC CONTROL TOWERS

TYPE OF CONSTRUCTION	HEIGHT[a] (feet)	MAXIMUM AREA (square feet)
IA	Unlimited	1,500
IB	240	1,500
IIA	100	1,500
IIB	85	1,500
IIIA	65	1,500

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.
a. Height to be measured from grade plane to cab floor.

412.1.3 Egress. A minimum of one exit stairway shall be permitted for airport traffic control towers of any height provided that the occupant load per floor does not exceed 15. The stairway shall conform to the requirements of Section 1009. The stairway shall be separated from elevators by a minimum distance of one-half of the diagonal of the area served measured in a straight line. The exit stairway and elevator hoistway are permitted to be located in the same shaft enclosure, provided they are separated from each other by a 4-hour fire barrier having no openings. Such stairway shall be pressurized to a minimum of 0.15 inch of water column (43 Pa) and a maximum of 0.35 inch of water column (101 Pa) in the shaft relative to the building with stairway doors closed. Stairways need not extend to the roof as specified in Section 1009.11. The provisions of Section 403 do not apply.

Exception: Smokeproof enclosures as set forth in Section 1020.1.7 are not required where required stairways are pressurized.

[F] 412.1.4 Automatic fire detection systems. Airport traffic control towers shall be provided with an automatic fire detection system installed in accordance with Section 907.2.

[F] 412.1.5 Standby power. A standby power system that conforms to Section 2702 shall be provided in airport traffic control towers more than 65 feet (19 812 mm) in height. Power shall be provided to the following equipment:

1. Pressurization equipment, mechanical equipment and lighting.
2. Elevator operating equipment.
3. Fire alarm and smoke detection systems.

412.1.6 Accessibility shall be in accordance with Chapter 11.

412.2 Aircraft hangars. Aircraft hangars shall be in accordance with Sections 412.2.1 through 412.2.6.

412.2.1 Exterior walls. Exterior walls located less than 30 feet (9 144 mm) lot lines or a public way shall have a fire-resistance rating not less than 2 hours.

412.2.2 Basements. Where hangars have basements, the floor over the basement shall be of Type IA construction and shall be made tight against seepage of water, oil or vapors. There shall be no opening or communication between the basement and the hangar. Access to the basement shall be from outside only.

412.2.3 Floor surface. Floors shall be graded and drained to prevent water or fuel from remaining on the floor. Floor drains shall discharge through an oil separator to the sewer or to an outside vented sump.

Exception: Aircraft hangars with individual lease spaces not exceeding 2,000 square feet (186 m^2) each in which servicing, repairing or washing is not conducted and fuel is not dispensed shall have floors that are graded toward the door, but shall not require a separator.

412.2.4 Heating equipment. Heating equipment shall be placed in another room separated by 2-hour fire-resistance-rated construction. Entrance shall be from the outside or by means of a vestibule providing a two-doorway separation.

Exceptions:

1. Unit heaters and vented infrared radiant heating equipment suspended at least 10 feet (3048 mm) above the upper surface of wings or engine enclosures of the highest aircraft that are permitted to be housed in the hangar and at least 8 feet (2438 mm) above the floor in shops, offices and other sections of the hangar communicating with storage or service areas.
2. A single interior door shall be allowed, provided the sources of ignition in the appliances are at least 18 inches (457 mm) above the floor.

412.2.5 Finishing. The process of "doping," involving use of a volatile flammable solvent, or of painting, shall be carried on in a separate detached building equipped with automatic fire-extinguishing equipment in accordance with Section 903.

[F] 412.2.6 Fire suppression. Aircraft hangars shall be provided with fire suppression as required by NFPA 409.

Exception: Group II hangars as defined in NFPA 409 storing private aircraft without major maintenance or overhaul are exempt from foam suppression requirements.

412.3 Residential aircraft hangars. Residential aircraft hangars as defined in Section 412.3.1 shall comply with Sections 412.3.2 through 412.3.6.

412.3.1 Definition. The following word and term shall, for the purposes of this chapter and as used elsewhere in this code, have the meaning shown herein.

RESIDENTIAL AIRCRAFT HANGAR. An accessory building less than 2,000 square feet (186 m^2) and 20 feet (6096 mm) in height, constructed on a one- or two-family residential property where aircraft are stored. Such use will be considered as a residential accessory use incidental to the dwelling.

412.3.2 Fire separation. A hangar shall not be attached to a dwelling unless separated by a fire barrier having a fire-resistance rating of not less than 1 hour. Such separation shall be continuous from the foundation to the underside of the roof and unpierced except for doors leading to the dwelling unit. Doors into the dwelling unit must be equipped with self-closing devices and conform to the requirements of Section 715 with at least a 4-inch (102 mm) noncombustible raised sill. Openings from a hanger directly into a room used for sleeping purposes shall not be permitted.

412.3.3 Egress. A hangar shall provide two means of egress. One of the doors into the dwelling shall be considered as meeting only one of the two means of egress.

[F] 412.3.4 Smoke alarms. Smoke alarms shall be provided within the hangar in accordance with Section 907.2.21.

412.3.5 Independent systems. Electrical, mechanical and plumbing drain, waste and vent (DWV) systems installed within the hangar shall be independent of the systems installed within the dwelling. Building sewer lines shall be permitted to be connect outside the structures.

Exception: Smoke detector wiring and feed for electrical subpanels in the hangar.

412.3.6 Height and area limits. Residential aircraft hangars shall not exceed 2,000 square feet (186 m^2) in area and 20 feet (6096 mm) in height.

[F] 412.4 Aircraft paint hangars. Aircraft painting operations where flammable liquids are used in excess of the maximum allowable quantities per control area listed in Table 307.7(1) shall be conducted in an aircraft paint hangar that complies with the provisions of Section 412.4.

[F] 412.4.1 Occupancy group. Aircraft paint hangars shall be classified as Group H-2. Aircraft paint hangars shall comply with the applicable requirements of this code and the *Florida Fire Prevention Code* for such occupancy.

412.4.2 Construction. The aircraft paint hangar shall be of Type I or II construction.

[F] 412.4.3 Operations. Only those flammable liquids necessary for painting operations shall be permitted in quantities less than the maximum allowable quantities per control area in Table 307.1(1). Spray equipment cleaning operations shall be conducted in a liquid use, dispensing and mixing room.

[F]412.4.4 Storage. Storage of flammable liquids shall be in a liquid storage room.

[F] 412.4.5 Fire suppression. Aircraft paint hangars shall be provided with fire suppression as required by NFPA 409.

412.4.6 Ventilation. Aircraft paint hangars shall be provided with ventilation as required in the *Florida Building Code, Mechanical*.

412.5 Heliports and helistops. Heliports and helistops shall be permitted to be erected on buildings or other locations where they are constructed in accordance with this section.

412.5.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

HELIPORT. An area of land or water or a structural surface that is used, or intended for use, for the landing and taking off of helicopters, and any appurtenant areas that are used, or intended for use, for heliport buildings and other heliport facilities.

HELISTOP. The same as a "Heliport," except that no fueling, defueling, maintenance, repairs or storage of helicopters is permitted.

412.5.2 Size. The landing area for helicopters less than 3,500 pounds (1588 kg) shall be a minimum of 20 feet (6096 mm) in length and width. The landing area shall be surrounded on all sides by a clear area having a minimum average width at roof level of 15 feet (4572 mm) but with no width less than 5 feet (1524 mm).

412.5.3 Design. Helicopter landing areas and the supports thereof on the roof of a building shall be noncombustible construction. Landing areas shall be designed to confine any flammable liquid spillage to the landing area itself and provisions shall be made to drain such spillage away from any exit or stairway serving the helicopter landing area or from a structure housing such exit or stairway. For structural design requirements, see Section 1605.5.

412.5.4 Means of egress. The means of egress from heliports and helistops shall comply with the provisions of Chapter 10. Landing areas located on buildings or structures shall have two or more means of egress. For landing areas less than 60 feet (18 288 mm) in length, or less than 2,000 square feet (186 m^2) in area, the second means of egress may be a fire escape or ladder leading to the floor below.

412.5.5 Rooftop heliports and helistops. Rooftop heliports and helistops shall comply with NFPA 418.

SECTION 413
COMBUSTIBLE STORAGE

413.1 General. High-piled stock or rack storage in any occupancy group shall comply with the *Florida Fire Prevention Code*.

413.2 Attic, under-floor and concealed spaces. Attic, under-floor and concealed spaces used for storage of combustible materials shall be protected on the storage side as required for 1-hour fire-resistance-rated construction. Openings shall be protected by assemblies that are self-closing and are of noncombustible construction or solid wood core not less than $1^3/_4$ inch (45 mm) in thickness.

Exceptions:

1. Areas protected by approved automatic sprinkler systems.
2. Group R-3 and U occupancies.

SECTION 414
HAZARDOUS MATERIALS

[F] 414.1 General. The provisions of this section shall apply to buildings and structures occupied for the manufacturing, processing, dispensing, use or storage of hazardous materials.

[F] 414.1.1 Other provisions. Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of Section 415 and the *Florida Fire Prevention Code*.

[F] 414.1.2 Materials. The safe design of hazardous material occupancies is material dependent. Individual material requirements are also found in Sections 307 and 415, and in the *Florida Building Code, Mechanical* and the *Florida Fire Prevention Code*.

[F] 414.1.2.1 Aerosols. Level 2 and 3 aerosol products shall be stored and displayed in accordance with the *Florida Fire Prevention Code*. See Section 311.2 and the *Florida Fire Prevention Code* for occupancy group requirements.

[F] 414.1.3 Information required. Separate floor plans shall be submitted for buildings and structures with an occupancy in Group H, identifying the locations of anticipated contents and processes so as to reflect the nature of each occupied portion of every building and structure. A report identifying hazardous materials including, but not limited to, materials representing hazards that are classified in Group H to be stored or used, shall be submitted and the methods of protection from such hazards shall be indicated on the construction documents. The opinion and report shall be prepared by a qualified person, firm or corporation approved by the building official and shall be provided without charge to the enforcing agency.

[F] 414.2 Control areas. Control areas shall comply with Sections 414.2.1 through 414.2.5 and the *Florida Fire Prevention Code*.

414.2.1 Construction requirements. Control areas shall be separated from each other by fire barriers constructed in accordance with Section 706 or horizontal assemblies constructed in accordance with Section 711, or both.

[F] 414.2.2 Percentage of maximum allowable quantities. The percentage of maximum allowable quantities of hazardous materials per control area permitted at each floor level within a building shall be in accordance with Table 414.2.2.

[F] 414.2.3 Number. The maximum number of control areas within a building shall be in accordance with Table 414.2.2.

[F] TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA[a]	NUMBER OF CONTROL AREAS PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS[b]
Above grade plane	Higher than 9	5	1	2
	7-9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade plane	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the notes to those tables.
b. Fire barriers shall include walls and floors as necessary to provide separation from other portions of the building.

414.2.4 Fire-resistance-rating requirements. The required fire-resistance rating for fire barriers shall be in accordance with Table 414.2.2. The floor construction of the control area and the construction supporting the floor of the control area shall have a minimum 2-hour fire-resistance rating.

Exception: The floor construction of the control area and the construction supporting the floor of the control area are allowed to be 1-hour fire-resistance rated in buildings of Type IIA, IIIA and VA construction, provided that both of the following conditions exist:

1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, and
2. The building is three stories or less in height.

[F] 414.2.5 Hazardous material in Group M display and storage areas and in Group S storage areas. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials permitted within a single control area of a Group M display and storage area, a Group S storage area or an outdoor control area is permitted to exceed the maximum allowable quantities per control area specified in Tables 307.1(1) and 307.1(2) without classifying the building or use as a Group H occupancy, provided that the materials are displayed and stored in accordance with the *Florida Fire Prevention Code* and quantities do not exceed the maximum allowable specified in Table 414.2.5(1).

In Group M occupancy wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area as indicated in Table 414.2.5(2), provided that the materials are displayed and stored in accordance with the *Florida Fire Prevention Code.*

The maximum quantity of aerosol products in Group M occupancy retail display areas, storage areas adjacent to retail display areas and retail storage areas shall be in accordance with the *Florida Fire Prevention Code.*

[F] 414.3 Ventilation. Rooms, areas or spaces of Group H in which explosive, corrosive, combustible, flammable or highly toxic dusts, mists, fumes, vapors or gases are or may be emitted due to the processing, use, handling or storage of materials shall be mechanically ventilated as required by the *Florida Fire Prevention Code* and the *Florida Building Code, Mechanical.*

Ducts conveying explosives or flammable vapors, fumes or dusts shall extend directly to the exterior of the building without entering other spaces. Exhaust ducts shall not extend into or through ducts and plenums.

Exception: Ducts conveying vapor or fumes having flammable constituents less than 25 percent of their lower flammable limit (LFL) are permitted to pass through other spaces.

Emissions generated at workstations shall be confined to the area in which they are generated as specified in the *Florida Fire Prevention Code* and the *Florida Building Code, Mechanical.*

The location of supply and exhaust openings shall be in accordance with the *Florida Building Code, Mechanical.* Exhaust air contaminated by highly toxic material shall be treated in accordance with the *Florida Fire Prevention Code.*

A manual shutoff control for ventilation equipment required by this section shall be provided outside the room adjacent to the principal access door to the room. The switch shall be of the break-glass type and shall be labeled: VENTILATION SYSTEM EMERGENCY SHUTOFF.

[F] 414.4 Hazardous material systems. Systems involving hazardous materials shall be suitable for the intended application. Controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. Automatic controls, where provided, shall be designed to be fail safe.

[F] 414.5 Inside storage, dispensing and use. The inside storage, dispensing and use of hazardous materials in excess of the maximum allowable quantities per control area of Tables 307.1(1) and 307.1(2) shall be in accordance with Sections

[F] TABLE 414.2.5(1)
MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN GROUP M AND S OCCUPANCIES NONFLAMMABLE SOLIDS AND NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS[d,e,f]

CONDITION		MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
Material[a]	Class	Solids pounds	Liquids gallons
A. Health-hazard materials—nonflammable and noncombustible solids and liquids			
1. Corrosives[b, c]	Not Applicable	9,750	975
2. Highly toxics	Not Applicable	20[b, c]	2[b, c]
3. Toxics[b, c]	Not Applicable	1,000	100
B. Physical-hazard materials—nonflammable and noncombustible solids and liquids			
1. Oxidizers[b, c]	4	Not Allowed	Not Allowed
	3	1,150[g]	115
	2	2,250[h]	225
	1	18,000[i, j]	1,800[i, j]
2. Unstable (reactives)[b, c]	4	Not Allowed	Not Allowed
	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water (reactives)	3[b, c]	550	55
	2[b, c]	1,150	115
	1	Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. Hazard categories are as specified in the *Florida Fire Prevention Code*.

b. Maximum allowable quantities shall be increased 100 percent in buildings that are sprinklered in accordance with Section 903.3.1.1. When Note c also applies, the increase for both notes shall be applied accumulatively.

c. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, in accordance with the *Florida Fire Prevention Code*. When Note b also applies, the increase for both notes shall be applied accumulatively.

d. See Table 414.2.2 for design and number of control areas.

e. Allowable quantities for other hazardous material categories shall be in accordance with Section 307.

f. Maximum quantities shall be increased 100 percent in outdoor control areas.

g. Maximum amounts are permitted to be increased to 2,250 pounds when individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.

h. Maximum amounts are permitted to be increased to 4,500 pounds when individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.

i. The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

j. Quantities are unlimited in an outdoor control area.

TABLE [F] 414.2.5(2)
MAXIMUM ALLOWABLE QUANTITY OF FLAMMABLE AND COMBUSTIBLE LIQUIDS IN WHOLESALE AND RETAIL SALES OCCUPANCIES PER CONTROL AREA[a]

TYPE OF LIQUID	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered in accordance with Note B densities and arrangements	Sprinklered in accordance with Tables 3404.3.6.3(4) through 3404.3.6.3(8) and Table 3404.3.7.5.1 of the *Florida Fire Prevention Code*	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500[c]	15,000[c]	1,600
Class IIIB	Unlimited	Unlimited	13,200

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 gallon = 3.785 L, 1 gallon per minute per square foot = 40.75 L/min/m^2.

a. Control areas shall be separated from each other by not less than a 1-hour fire barrier wall.

b. To be considered as sprinklered, a building shall be equipped throughout with an approved automatic sprinkler system with a design providing minimum densities as follows:
   1. For uncartoned commodities on shelves 6 feet or less in height where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of Ordinary Hazard Group 2.
   2. For cartoned, palletized or racked commodities where storage is 4 feet 6 inches or less in height and where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of 0.21 gallon per minute per square foot over the most remote 1,500-square-foot area.

c. Where wholesale and retail sales or storage areas exceed 50,000 square feet in area, the maximum allowable quantities are allowed to be increased by 2 percent for each 1,000 square feet of area in excess of 50,000 square feet, up to a maximum of 100 percent of the table amounts. A control area separation is not required. The cumulative amounts, including amounts attained by having an additional control area, shall not exceed 30,000 gallons.

414.5.1 through 414.5.5 of this code and the *Florida Fire Prevention Code*.

[F] 414.5.1 Explosion control. Explosion control shall be provided in accordance with the *Florida Fire Prevention Code* as required by Table 414.5.1 where quantities of hazardous materials specified in that table exceed the maximum allowable quantities in Table 307.1(1) or where a structure, room or space is occupied for purposes involving explosion hazards as required by Section 415 or the *Florida Fire Prevention Code*.

[F] 414.5.2 Monitor control equipment. Monitor control equipment shall be provided where required by the *Florida Fire Prevention Code*.

[F] 414.5.3 Automatic fire detection systems. Group H occupancies shall be provided with an automatic fire detection system in accordance with Section 907.2.

[F] 414.5.4 Standby or emergency power. Where mechanical ventilation, treatment systems, temperature control, alarm, detection or other electrically operated systems are required, such systems shall be provided with an emergency or standby power system in accordance with this code or Chapter 27 of the *Florida Building Code, Building*.

Exceptions:

1. Storage areas for Class I and II oxidizers.
2. Storage areas for Class III, IV and V organic peroxides.
3. Storage, use and handling areas for highly toxic or toxic materials as provided for in the *Florida Fire Prevention Code*.
4. Standby power for mechanical ventilation, treatment systems and temperature control systems shall not be required where an approved fail-safe engineered system is installed.

[F] 414.5.5 Spill control, drainage and containment. Rooms, buildings or areas occupied for the storage of solid and liquid hazardous materials shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in the *Florida Fire Prevention Code*. The methods of spill control shall be in accordance with the *Florida Fire Prevention Code*.

[F] 414.6 Outdoor storage, dispensing and use. The outdoor storage, dispensing and use of hazardous materials shall be in accordance with the *Florida Fire Prevention Code*.

[F] 414.6.1 Weather protection. Where weather protection is provided for sheltering outdoor hazardous material storage or use areas, such areas shall be considered outdoor storage or use when the weather protection structure complies with Sections 414.6.1.1 through 414.6.1.3.

[F] 414.6.1.1 Walls. Walls shall not obstruct more than one side of the structure.

Exception: Walls shall be permitted to obstruct portions of multiple sides of the structure, provided that the obstructed area does not exceed 25 percent of the structure's perimeter.

[F] 414.6.1.2 Separation distance. The distance from the structure to buildings, lot lines, public ways or means of egress to a public way shall not be less than the distance required for an outside hazardous material storage or use area without weather protection.

[F] 414.6.1.3 Noncombustible construction. The overhead structure shall be of approved noncombustible construction with a maximum area of 1,500 square feet (140 m^2).

Exception: The increases permitted by Section 506 apply.

[F] TABLE 414.5.1
EXPLOSION CONTROL REQUIREMENTS[a]

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems[b]
HAZARD CATEGORY			
Combustible dusts[c]	—	Not Required	Required
Cryogenic flammables	—	Not Required	Required
Explosives	Division 1.1	Required	Not Required
	Division 1.2	Required	Not Required
	Division 1.3	Not Required	Required
	Division 1.4	Not Required	Required
	Division 1.5	Required	Not Required
	Division 1.6	Required	Not Required
Flammable gas	Gaseous	Not Required	Required
	Liquefied	Not Required	Required
Flammable liquid	IA[d]	Not Required	Required
	IB[e]	Not Required	Required
Organic peroxides	U	Required	Not Permitted
	I	Required	Not Permitted
Oxidizer liquids and solids	4	Required	Not Permitted
Pyrophoric gas	—	Not Required	Required
Unstable (reactive)	4	Required	Not Permitted
	3 Detonable	Required	Not Permitted
	3 Nondetonable	Not Required	Required
Water-reactive liquids and solids	3	Not Required	Required
	2[g]	Not Required	Required
SPECIAL USES			
Acetylene generator rooms	—	Not Required	Required
Grain processing	—	Not Required	Required
Liquefied petroleum gas- distribution facilities	—	Not Required	Required
Where explosion hazards exist[f]	Detonation	Required	Not Permitted
	Deflagration	Not Required	Required

a. See Section 414.1.3.
b. See the *Florida Fire Prevention Code*.
c. As generated during manufacturing or processing. See definition of "Combustible dust" in Chapter 3.
d. Storage or use.
e. In open use or dispensing.
f. Rooms containing dispensing and use of hazardous materials when an explosive environment can occur because of the characteristics or nature of the hazardous materials or as a result of the dispensing or use process.
g. A method of explosion control shall be provided when Class 2 water-reactive materials can form potentially explosive mixtures.

[F] 414.7 Emergency alarms. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as set forth herein.

[F] 414.7.1 Storage. An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials. Emergency alarm-initiating devices shall be installed outside of each interior exit or exit access door of storage buildings, rooms or areas. Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.

[F] 414.7.2 Dispensing, use and handling. Where hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 are transported through corridors or exit enclosures, there shall be an emergency telephone system, a local manual alarm station or an approved alarm-initiating device at not more than 150-foot (45 720 mm) intervals and at each exit and exit access doorway throughout the transport route. The signal shall be relayed to an approved central, proprietary or remote station service or constantly attended on-site location and shall also initiate a local audible alarm.

[F] 414.7.3 Supervision. Emergency alarm systems shall be supervised by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location.

SECTION 415
GROUPS H-1, H-2, H-3, H-4 AND H-5

[F] 415.1 Scope. The provisions of this section shall apply to the storage and use of hazardous materials in excess of the maximum allowable quantities per control area listed in Section 307.1. Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of Section 414 and the *Florida Fire Prevention Code*.

[F] 415.2 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in the code, have the meanings shown herein.

[F] CONTINUOUS GAS-DETECTION SYSTEM. A gas detection system where the analytical instrument is maintained in continuous operation and sampling is performed without interruption. Analysis is allowed to be performed on a cyclical basis at intervals not to exceed 30 minutes.

[F] EMERGENCY CONTROL STATION. An approved location on the premises where signals from emergency equipment are received and which is staffed by trained personnel.

[F] EXHAUSTED ENCLOSURE. An appliance or piece of equipment that consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors and mists that could be released. Rooms or areas provided with general ventilation, in themselves, are not exhausted enclosures.

[F] FABRICATION AREA. An area within a semiconductor fabrication facility and related research and development areas in which there are processes using hazardous production materials. Such areas are allowed to include ancillary rooms or areas such as dressing rooms and offices that are directly related to the fabrication area processes.

[F] FLAMMABLE VAPORS OR FUMES. The concentration of flammable constituents in air that exceed 25 percent of their lower flammable limit (LFL).

[F] GAS CABINET. A fully enclosed, noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are allowed to be included.

[F] GAS ROOM. A separately ventilated, fully enclosed room in which only compressed gases and associated equipment and supplies are stored or used.

[F] HAZARDOUS PRODUCTION MATERIAL (HPM). A solid, liquid or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or reactivity of Class 3 or 4 as ranked by NFPA 704 and which is used directly in research, laboratory or production processes that have as their end product materials that are not hazardous.

[F] HPM FLAMMABLE LIQUID. An HPM liquid that is defined as either a Class I flammable liquid or a Class II or Class IIIA combustible liquid.

[F] HPM ROOM. A room used in conjunction with or serving a Group H-5 occupancy, where HPM is stored or used and which is classified as a Group H-2, H-3 or H-4 occupancy.

[F] IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH). The concentration of air-borne contaminants which poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It generally is expressed in parts per million by volume (ppm v/v) or milligrams per cubic meter (mg/m^3). If adequate data do not exist for precise establishment of IDLH concentrations, an independent certified industrial hygienist, industrial toxicologist, appropriate regulatory agency or other source approved by the code official shall make such determination.

[F] LIQUID. A material that has a melting point that is equal to or less than 68°F (20°C) and a boiling point that is greater than 68°F (20°C) at 14.7 pounds per square inch absolute (psia) (101 kPa). When not otherwise identified, the term "liquid" includes both flammable and combustible liquids.

[F] LIQUID STORAGE ROOM. A room classified as a Group H-3 occupancy used for the storage of flammable or combustible liquids in a closed condition.

[F] LIQUID USE, DISPENSING AND MIXING ROOM. A room in which Class I, II and IIIA flammable or combustible liquids are used, dispensed or mixed in open containers.

[F] LOWER FLAMMABLE LIMIT (LFL). The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as "LEL" or "lower explosive limit."

[F] NORMAL TEMPERATURE AND PRESSURE (NTP). A temperature of 70°F (21°C) and a pressure of 1 atmosphere [14.7 psia (101 kPa)].

[F] PHYSIOLOGICAL WARNING THRESHOLD LEVEL. A concentration of air-borne contaminants, normally expressed in parts per million (ppm) or milligrams per cubic meter, that represents the concentration at which persons can sense the presence of the contaminant due to odor, irritation or other quick-acting physiological response. When used in conjunction with the permissible exposure limit (PEL) the physiological warning threshold levels are those consistent with the classification system used to establish the PEL. See the definition of "Permissible exposure limit (PEL)" in the *Florida Fire Prevention Code*.

[F] SERVICE CORRIDOR. A fully enclosed passage used for transporting HPM and purposes other than required means of egress.

[F] SOLID. A material that has a melting point, decomposes or sublimes at a temperature greater than 68°F (20°C).

[F] STORAGE, HAZARDOUS MATERIALS.

1. The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders or similar vessels, or
2. Vessels supplying operations through closed connections to the vessel.

[F] USE (MATERIAL). Placing a material into action, including solids, liquids and gases.

[F] WORKSTATION. A defined space or an independent principal piece of equipment using HPM within a fabrication area where a specific function, laboratory procedure or research activity occurs. Approved or listed hazardous materials storage cabinets, flammable liquid storage cabinets or gas cabinets serving a workstation are included as part of the workstation. A workstation is allowed to contain ventilation equipment, fire protection devices, detection devices, electrical devices and other processing and scientific equipment.

[F] 415.3 Fire separation distance. Group H occupancies shall be located on property in accordance with the other provisions of this chapter. In Groups H-2 and H-3, not less than 25 percent of the perimeter wall of the occupancy shall be an exterior wall.

Exceptions:

1. Liquid use, dispensing and mixing rooms having a floor area of not more than 500 square feet (46.5 m^2) need not be located on the outer perimeter of the building where they are in accordance with the *Florida Fire Prevention Code* and NFPA 30.
2. Liquid storage rooms having a floor area of not more than 1,000 square feet (93 m^2) need not be located on the outer perimeter where they are in accordance with the *Florida Fire Prevention Code* and NFPA 30.
3. Spray paint booths that comply with the *Florida Fire Prevention Code* need not be located on the outer perimeter.

[F] 415.3.1 Group H occupancy minimum fire separation distance. Regardless of any other provisions, buildings containing Group H occupancies shall be set back to the minimum fire separation distance as set forth in Items 1 through 4 below. Distances shall be measured from the walls enclosing the occupancy to lot lines, including those on a public way. Distances to assumed lot lines established for the purpose of determining exterior wall and opening protection are not to be used to establish the minimum fire separation distance for buildings on sites where explosives are manufactured or used when separation is provided in accordance with the quantity distance tables specified for explosive materials in the *Florida Fire Prevention Code*.

1. Group H-1. Not less than 75 feet (22 860 mm) and not less than required by the *Florida Fire Prevention Code*.

   Exceptions:

   1. Fireworks manufacturing buildings separated in accordance with NFPA 1124.
   2. Buildings containing the following materials when separated in accordance with Table 415.3.1:
      - 2.1. Organic peroxides, unclassified detonable.
      - 2.2. Unstable reactive materials, Class 4.
      - 2.3. Unstable reactive materials, Class 3 detonable.
      - 2.4. Detonable pyrophoric materials.
2. Group H-2. Not less than 30 feet (9144 mm) where the area of the occupancy exceeds 1,000 square feet (93 m^2) and it is not required to be located in a detached building.
3. Groups H-2 and H-3. Not less than 50 feet (15 240 mm) where a detached building is required (see Table 415.3.2).
4. Groups H-2 and H-3. Occupancies containing materials with explosive characteristics shall be separated as required by the *Florida Fire Prevention Code*. Where separations are not specified, the distances required shall not be less than the distances required by Table 415.3.1.

[F] 415.3.2 Group H-1 and H-2 or H-3 detached buildings. Where a detached building is required by Table 415.3.2, there are no requirements for wall and opening protection based on fire separation distance.

[F] 415.4 Special provisions for Group H-1 occupancies. Group H-1 occupancies shall be in buildings used for no other purpose, shall not exceed one story in height and be without a basement, crawl spaces or other under-floor spaces. Roofs shall be of lightweight construction with suitable thermal insulation to prevent sensitive material from reaching its decomposition temperature.

Group H-1 occupancies containing materials which are in themselves both physical and health hazards in quantities exceeding the maximum allowable quantities per control area in Table 307.1.(2) shall comply with requirements for both Group H-1 and H-4 occupancies.

[F] 415.4.1 Floors in storage rooms. Floors in storage areas for organic peroxides, pyrophoric materials and unstable (reactive) materials shall be of liquid-tight, noncombustible construction.

[F] 415.5 Special provisions for Group H-2 and H-3 occupancies. Group H-2 and H-3 occupancies containing quantities of hazardous materials in excess of those set forth in Table 415.3.2 shall be in buildings used for no other purpose, shall not exceed one story in height and shall be without basements, crawl spaces or other under-floor spaces.

Group H-2 and H-3 occupancies containing water-reactive materials shall be resistant to water penetration. Piping for conveying liquids shall not be over or through areas containing water reactives, unless isolated by approved liquid-tight construction.

Exception: Fire protection piping.

[F] 415.5.1 Floors in storage rooms. Floors in storage areas for organic peroxides, oxidizers, pyrophoric materials, unstable (reactive) materials and water-reactive solids and liquids shall be of liquid-tight, noncombustible construction.

[F] 415.5.2 Waterproof room. Rooms or areas used for the storage of water-reactive solids and liquids shall be constructed in a manner that resists the penetration of water through the use of waterproof materials. Piping carrying water for other than approved automatic fire sprinkler systems shall not be within such rooms or areas.

[F] TABLE 415.3.1
MINIMUM SEPARATION DISTANCES FOR BUILDINGS CONTAINING EXPLOSIVE MATERIALS

QUANTITY OF EXPLOSIVE MATERIAL[a]		MINIMUM DISTANCE (feet)		
		Lot lines[b] and inhabited buildings[c]		
Pounds over	Pounds not over	Barricaded[d]	Unbarricaded	Separation of magazines[d, e, f]
2	5	70	140	12
5	10	90	180	16
10	20	110	220	20
20	30	125	250	22
30	40	140	280	24
40	50	150	300	28
50	75	170	340	30
75	100	190	380	32
100	125	200	400	36
125	150	215	430	38
150	200	235	470	42
200	250	255	510	46
250	300	270	540	48
300	400	295	590	54
400	500	320	640	58
500	600	340	680	62
600	700	355	710	64
700	800	375	750	66
800	900	390	780	70
900	1,000	400	800	72
1,000	1,200	425	850	78
1,200	1,400	450	900	82
1,400	1,600	470	940	86
1,600	1,800	490	980	88
1,800	2,000	505	1,010	90
2,000	2,500	545	1,090	98
2,500	3,000	580	1,160	104
3,000	4,000	635	1,270	116
4,000	5,000	685	1,370	122
5,000	6,000	730	1,460	130
6,000	7,000	770	1,540	136
7,000	8,000	800	1,600	144
8,000	9,000	835	1,670	150
9,000	10,000	865	1,730	156
10,000	12,000	875	1,750	164
12,000	14,000	885	1,770	174
14,000	16,000	900	1,800	180
16,000	18,000	940	1,880	188
18,000	20,000	975	1,950	196
20,000	25,000	1,055	2,000	210
25,000	30,000	1,130	2,000	224
30,000	35,000	1,205	2,000	238
35,000	40,000	1,340	2,000	248

(continued)

TABLE 415.3.1—continued
MINIMUM SEPARATION DISTANCES FOR BUILDINGS CONTAINING EXPLOSIVE MATERIALS

QUANTITY OF EXPLOSIVE MATERIAL[a]		MINIMUM DISTANCE (feet)		
		Lot lines[b] and inhabited buildings[c]		
Pounds over	Pounds not over	Barricaded[d]	Unbarricaded	Separation of magazines[d, e, f]
40,000	45,000	1,340	2,000	258
45,000	50,000	1,400	2,000	270
50,000	55,000	1,460	2,000	280
55,000	60,000	1,515	2,000	290
60,000	65,000	1,565	2,000	300
65,000	70,000	1,610	2,000	310
70,000	75,000	1,655	2,000	320
75,000	80,000	1,695	2,000	330
80,000	85,000	1,730	2,000	340
85,000	90,000	1,760	2,000	350
90,000	95,000	1,790	2,000	360
95,000	100,000	1,815	2,000	370
100,000	110,000	1,835	2,000	390
110,000	120,000	1,855	2,000	410
120,000	130,000	1,875	2,000	430
130,000	140,000	1,890	2,000	450
140,000	150,000	1,900	2,000	470
150,000	160,000	1,935	2,000	490
160,000	170,000	1,965	2,000	510
170,000	180,000	1,990	2,000	530
180,000	190,000	2,010	2,010	550
190,000	200,000	2,030	2,030	570
200,000	210,000	2,055	2,055	590
210,000	230,000	2,100	2,100	630
230,000	250,000	2,155	2,155	670
250,000	275,000	2,215	2,215	720
275,000	300,000	2,275	2,275	770

For SI: 1 pound = 0.454 kg, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. The number of pounds of explosives listed is the number of pounds of trinitrotoluene (TNT) or the equivalent pounds of other explosive.

b. The distance listed is the distance to lot line, including lot lines at public ways.

c. For the purpose of this table, an inhabited building is any building on the same lot that is regularly occupied by people. Where two or more buildings containing explosives or magazines are located on the same lot, each building or magazine shall comply with the minimum distances specified from inhabited buildings and, in addition, they shall be separated from each other by not less than the distance shown for "Separation of magazines," except that the quantity of explosive materials contained in detonator buildings or magazines shall govern in regard to the spacing of said detonator buildings or magazines from buildings or magazines containing other explosive materials. If any two or more buildings or magazines are separated from each other by less than the specified "Separation of Magazines" distances, then such two or more buildings or magazines, as a group, shall be considered as one building or magazine, and the total quantity of explosive materials stored in such group shall be treated as if the explosive were in a single building or magazine located on the site of any building or magazine of the group, and shall comply with the minimum distance specified from other magazines or inhabited buildings.

d. Barricades shall effectively screen the building containing explosives from other buildings, public ways or magazines. Where mounds or revetted walls of earth are used for barricades, they shall not be less than 3 feet in thickness. A straight line from the top of any side wall of the building containing explosive materials to the eave line of any other building, magazine or a point 12 feet above the centerline of a public way shall pass through the barricades.

e. Magazine is a building or structure, other than an operating building, approved for storage of explosive materials. Portable or mobile magazines not exceeding 120 square feet (11 m^2) in area need not comply with the requirements of this code, however, all magazines shall comply with the *Florida Fire Prevention Code*.

f. The distance listed is permitted to be reduced by 50 percent where approved natural or artificial barriers are provided in accordance with the requirements in Note d.

[F] TABLE 415.3.2
REQUIRED DETACHED STORAGE

DETACHED STORAGE IS REQUIRED WHEN THE QUANTITY OF MATERIAL EXCEEDS THAT LISTED HEREIN			
Material	**Class**	**Solids and Liquids (tons)[a,b]**	**Gases (cubic feet)[a,b]**
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4[c] Division 1.5 Division 1.6	Maximum Allowable Quantity Maximum Allowable Quantity Maximum Allowable Quantity Maximum Allowable Quantity 1 Maximum Allowable Quantity Maximum Allowable Quantity	Not Applicable
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3 Class 2	1,200 2,000	Not Applicable Not Applicable
Organic peroxides	Detonable Class I Class II Class III	Maximum Allowable Quantity Maximum Allowable Quantity 25 50	Not Applicable Not Applicable Not Applicable Not Applicable
Unstable (reactives) nondetonable	Class 3 Class 2	1 25	2,000 10,000
Water reactives	Class 3 Class 2	1 25	Not Applicable Not Applicable
Pyrophoric gases	Not Applicable	Not Applicable	2,000

For SI: 1 ton = 906 kg, 1 cubic foot = 0.02832 m^3, 1 pound = 0.454 kg.

a. For materials that are detonable, the distance to other buildings or lot lines shall be as specified in Table 415.3.1 based on trinitrotoluene (TNT) equivalence of the material. For materials classified as explosives, see the *Florida Fire Prevention Code*. For all other materials, the distance shall be as indicated in Section 415.3.1.

b. "Maximum Allowable Quantity" means the maximum allowable quantity per control area set forth in Table 307.7(1).

c. Limited to Division 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco and Firearms (BATF) regulations or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles, providing the net explosive weight of individual articles does not exceed 1 pound.

[F] 415.6 Group H-2. Occupancies in Group H-2 shall be constructed in accordance with Sections 415.6.1 through 415.6.4 and the *Florida Fire Prevention Code*.

[F] 415.6.1 Combustible dusts, grain processing and storage. The provisions of Sections 415.6.1.1 through 415.6.1.6 shall apply to buildings in which materials that produce combustible dusts are stored or handled. Buildings that store or handle combustible dusts shall comply with the applicable provisions of NFPA 61, NFPA 120, NFPA 484, NFPA 654, NFPA 655, NFPA 664 and NFPA 85, and the *Florida Fire Prevention Code*.

[F] 415.6.1.1 Type of construction and height exceptions. Buildings shall be constructed in compliance with the height and area limitations of Table 503 for Group H-2; except that where erected of Type I or II construction, the heights and areas of grain elevators and similar structures shall be unlimited, and where of Type IV construction, the maximum height shall be 65 feet (19 812 mm) and except further that, in isolated areas, the maximum height of Type IV structures shall be increased to 85 feet (25 908 mm).

[F] 415.6.1.2 Grinding rooms. Every room or space occupied for grinding or other operations that produce combustible dusts shall be enclosed with fire barriers that have not less than a 2-hour fire-resistance rating where the area is not more than 3,000 square feet (279 m^2), and not less than a 4-hour fire-resistance rating where the area is greater than 3,000 square feet (279 m^2).

[F] 415.6.1.3 Conveyors. Conveyors, chutes, piping and similar equipment passing through the enclosures of rooms or spaces shall be constructed dirt tight and vapor tight, and be of approved noncombustible materials complying with Chapter 30.

[F] 415.6.1.4 Explosion control. Explosion control shall be provided as specified in the *Florida Fire Prevention Code*, or spaces shall be equipped with the equivalent mechanical ventilation complying with the *Florida Building Code, Mechanical*.

[F] 415.6.1.5 Grain elevators. Grain elevators, malt houses and buildings for similar occupancies shall not be located within 30 feet (9144 mm) of interior lot lines or structures on the same lot, except where erected along a railroad right-of-way.

[F] 415.6.1.6 Coal pockets. Coal pockets located less than 30 feet (9144 mm) from interior lot lines or from structures on the same lot shall be constructed of not less

than Type IB construction. Where more than 30 feet (9144 mm) from interior lot lines, or where erected along a railroad right-of-way, the minimum type of construction of such structures not more than 65 feet (19 812 mm) in height shall be Type IV.

[F] 415.6.2 Flammable and combustible liquids. The storage, handling, processing and transporting of flammable and combustible liquids shall be in accordance with the *Florida Building Code, Mechanical* and the *Florida Fire Prevention Code.*

[F] 415.6.2.1 Mixed occupancies. Where the storage tank area is located in a building of two or more occupancies, and the quantity of liquid exceeds the maximum allowable quantity for one control area, the use shall be completely separated from adjacent fire areas in accordance with the requirements of Section 508.3.3.

[F] 415.6.2.1.1 Height exception. Where storage tanks are located within only a single-story building, the height limitation of Section 503 shall not apply for Group H.

[F] 415.6.2.2 Tank protection. Storage tanks shall be noncombustible and protected from physical damage. A fire barrier wall or horizontal assemblies or both around the storage tank(s) shall be permitted as the method of protection from physical damage.

[F] 415.6.2.3 Tanks. Storage tanks shall be approved tanks conforming to the requirements of the *Florida Fire Prevention Code.*

[F] 415.6.2.4 Suppression. Group H shall be equipped throughout with an approved automatic sprinkler system, installed in accordance with Section 903.

[F] 415.6.2.5 Leakage containment. A liquid-tight containment area compatible with the stored liquid shall be provided. The method of spill control, drainage control and secondary containment shall be in accordance with the *Florida Fire Prevention Code.*

Exception: Rooms where only double-wall storage tanks conforming to Section 415.6.2.3 are used to store Class I, II and IIIA flammable and combustible liquids shall not be required to have a leakage containment area.

[F] 415.6.2.6 Leakage alarm. An approved automatic alarm shall be provided to indicate a leak in a storage tank and room. The alarm shall sound an audible signal, 15 dBa above the ambient sound level, at every point of entry into the room in which the leaking storage tank is located. An approved sign shall be posted on every entry door to the tank storage room indicating the potential hazard of the interior room environment, or the sign shall state: WARNING, WHEN ALARM SOUNDS, THE ENVIRONMENT WITHIN THE ROOM MAY BE HAZARDOUS. The leakage alarm shall also be supervised in accordance with Chapter 9 to transmit a trouble signal.

[F] 415.6.2.7 Tank vent. Storage tank vents for Class I, II or IIIA liquids shall terminate to the outdoor air in accordance with the *Florida Fire Prevention Code.*

[F] 415.6.2.8 Room ventilation. Storage tank areas storing Class I, II or IIIA liquids shall be provided with mechanical ventilation. The mechanical ventilation system shall be in accordance with the *Florida Building Code, Mechanical* and the *Florida Fire Prevention Code.*

[F] 415.6.2.9 Explosion venting. Where Class I liquids are being stored, explosion venting shall be provided in accordance with the *Florida Fire Prevention Code.*

[F] 415.6.2.10 Tank openings other than vents. Tank openings other than vents from tanks inside buildings shall be designed to ensure that liquids or vapor concentrations are not released inside the building.

[F] 415.6.3 Liquefied petroleum gas-distribution facilities. The design and construction of propane, butane, propylene, butylene and other liquefied petroleum gas-distribution facilities shall conform to the applicable provisions of Sections 415.6.3.1 through 415.6.3.5.2. The storage and handling of liquefied petroleum gas systems shall conform to the *Florida Fire Prevention Code.* The design and installation of piping, equipment and systems that utilize liquefied petroleum gas shall be in accordance with the *Florida Building Code, Fuel Gas.* Liquefied petroleum gas-distribution facilities shall be ventilated in accordance with the *Florida Building Code, Mechanical* and Section 415.6.3.1.

[F] 415.6.3.1 Air movement. Liquefied petroleum gas-distribution facilities shall be provided with air inlets and outlets arranged so that air movement across the floor of the facility will be uniform. The total area of both inlet and outlet openings shall be at least 1 square inch (645 mm^2) for each 1 square foot (0.093 m^2) of floor area. The bottom of such openings shall not be more than 6 inches (152 mm) above the floor.

[F] 415.6.3.2 Construction. Liquefied petroleum gas-distribution facilities shall be constructed in accordance with Section 415.6.3.3 for separate buildings, Section 415.6.3.4 for attached buildings or Section 415.6.3.5 for rooms within buildings.

[F] 415.6.3.3 Separate buildings. Where located in separate buildings, liquefied petroleum gas-distribution facilities shall be occupied exclusively for that purpose or for other purposes having similar hazards. Such buildings shall be limited to one story in height and shall conform to Sections 415.6.3.3.1 through 415.6.3.3.3.

[F] 415.6.3.3.1 Floors. The floor shall not be located below ground level and any spaces beneath the floor shall be solidly filled or shall be unenclosed.

[F] 415.6.3.3.2 Materials. Walls, floors, ceilings, columns and roofs shall be constructed of noncombustible materials.

[F] 415.6.3.3.3 Explosion venting. Explosion venting shall be provided in accordance with the *Florida Fire Prevention Code*.

[F] 415.6.3.4 Attached buildings. Where liquefied petroleum gas-distribution facilities are located in an attached structure, the attached perimeter shall not exceed 50 percent of the perimeter of the space enclosed and the facility shall comply with Sections 415.6.3.3 and 415.6.3.4.1. Where the attached perimeter exceeds 50 percent, such facilities shall comply with Section 415.6.3.5.

[F] 415.6.3.4.1 Fire separation. Separation of the attached structures shall be provided by fire barriers having a fire-resistance rating of not less than 1 hour and shall not have openings. Fire barriers between attached structures occupied only for the storage of LP-gas are permitted to have fire door assemblies that comply with Section 715. Such fire barriers shall be designed to withstand a static pressure of at least 100 pounds per square foot (psf) (4788 Pa), except where the building to which the structure is attached is occupied by operations or processes having a similar hazard.

[F] 415.6.3.5 Rooms within buildings. Where liquefied petroleum gas-distribution facilities are located in rooms within buildings, such rooms shall be located in the first story above grade plane and shall have at least one exterior wall with sufficient exposed area to provide explosion venting as required in the *Florida Fire Prevention Code*. The building in which the room is located shall not have a basement or unventilated crawl space and the room shall comply with Sections 415.6.3.5.1 and 415.6.3.5.2.

[F] 415.6.3.5.1 Materials. Walls, floors, ceilings and roofs of such rooms shall be constructed of approved noncombustible materials.

[F] 415.6.3.5.2 Common construction. Walls and floor/ceiling assemblies common to the room and to the building where the room is located shall be fire barriers with not less than a 1-hour fire-resistance rating and without openings. Common walls for rooms occupied only for storage of LP-gas are permitted to have opening protectives complying with Section 715. The walls and ceilings shall be designed to withstand a static pressure of at least 100 psf (4788 Pa).

Exception: Where the building, within which the room is located, is occupied by operations or processes having a similar hazard.

[F] 415.6.4 Dry cleaning plants. The construction and installation of dry cleaning plants shall be in accordance with the requirements of this code, the *Florida Building Code, Mechanical*, the *Florida Building Code, Plumbing* and NFPA 32. Dry cleaning solvents and systems shall be classified in accordance with the *Florida Fire Prevention Code*.

[F] 415.7 Groups H-3 and H-4. Groups H-3 and H-4 shall be constructed in accordance with the applicable provisions of this code and the *Florida Fire Prevention Code*.

[F] 415.7.1 Gas rooms. When gas rooms are provided, such rooms shall be separated from other areas by not less than a 1-hour fire barrier.

[F] 415.7.2 Floors in storage rooms. Floors in storage areas for corrosive liquids and highly toxic or toxic materials shall be of liquid-tight, noncombustible construction.

[F] 415.7.3 Separation—highly toxic solids and liquids. Highly toxic solids and liquids not stored in approved hazardous materials storage cabinets shall be isolated from other hazardous materials storage by a fire barrier having a fire-resistance rating of not less than 1 hour.

[F] 415.8 Group H-5.

[F] 415.8.1 General. In addition to the requirements set forth elsewhere in this code, Group H-5 shall comply with the provisions of Section 415.8 and the *Florida Fire Prevention Code*.

[F] 415.8.2 Fabrication areas.

[F] 415.8.2.1 Hazardous materials in fabrication areas.

[F] 415.8.2.1.1 Aggregate quantities. The aggregate quantities of hazardous materials stored and used in a single fabrication area shall not exceed the quantities set forth in Table 415.8.2.1.1.

Exception: The quantity limitations for any hazard category in Table 415.8.2.1.1 shall not apply where the fabrication area contains quantities of hazardous materials not exceeding the maximum allowable quantities per control area established by Tables 307.1(1) and 307.1(2).

[F] 415.8.2.1.2 Hazardous production materials. The maximum quantities of hazardous production materials (HPM) stored in a single fabrication area shall not exceed the maximum allowable quantities per control area established by Tables 307.1(1) and 307.1(2).

[F] 415.8.2.2 Separation. Fabrication areas, whose sizes are limited by the quantity of hazardous materials allowed by Table 415.8.2.1.1, shall be separated from each other, from corridors and from other parts of the building by not less than 1-hour fire barriers.

Exceptions:

1. Doors within such fire barrier walls, including doors to corridors, shall be only self-closing fire door assemblies having a fire protection rating of not less than $^3/_4$ hour.
2. Windows between fabrication areas and corridors are permitted to be fixed glazing listed and labeled for a fire protection rating of at least $^3/_4$ hour in accordance with Section 715.

[F] TABLE 415.8.2.1.1
QUANTITY LIMITS FOR HAZARDOUS MATERIALS IN A SINGLE FABRICATION AREA IN GROUP H-5[a]

HAZARD CATEGORY		SOLIDS (pounds per square feet)	LIQUIDS (gallons per square feet)	GAS (feet^3 @ NTP/square feet)
PHYSICAL-HAZARD MATERIALS				
Combustible dust		Note b	Not Applicable	Not Applicable
Combustible fiber	Loose Baled	Note b Notes b, c	Not Applicable	Not Applicable
Combustible liquid Combination Class I, II and IIIA	II IIIA IIIB	Not Applicable	0.01 0.02 Not Limited 0.04	Not Applicable
Cryogenic gas	Flammable Oxidizing	Not Applicable	Not Applicable	Note d 1.25
Explosives		Note b	Note b	Note b
Flammable gas	Gaseous Liquefied	Not Applicable	Not Applicable	Note d Note d
Flammable liquid Combination Class IA, IB and IC Combination Class I, II and IIIA	IA IB IC	Not Applicable	0.0025 0.025 0.025 0.025 0.04	Not Applicable
Flammable solid		0.001	Not Applicable	Not Applicable
Organic peroxide Unclassified detonable Class I Class II Class III Class IV Class V		Note b Note b 0.025 0.1 Not Limited Not limited	Not Applicable	Not Applicable
Oxidizing gas Combination of gaseous and liquefied	Gaseous Liquefied	Not Applicable	Not Applicable	1.25 1.25 1.25
Oxidizer Combination	Class 4 Class 3 Class 2 Class 1 Class 1, 2, 3	Note b 0.003 0.003 0.003 0.003	Note b 0.003 0.003 0.003 0.003	Not Applicable
Pyrophoric material		Note b	0.00125	Notes d and e
Unstable reactive	Class 4 Class 3 Class 2 Class 1	Note b 0.025 0.1 Not Limited	Note b 0.0025 0.01 Not Limited	Note b Note b Note b Not Limited
Water reactive	Class 3 Class 2 Class 1	Note b 0.25 Not Limited	0.00125 0.025 Not Limited	Not Applicable
HEALTH-HAZARD MATERIALS				
Corrosives		Not Limited	Not Limited	Not Limited
Highly toxic		Not Limited	Not Limited	Note d
Toxics		Not Limited	Not Limited	Note d

For SI: 1 pound per square foot = 4.882 kg/m^2, 1 gallon per square foot = 40.7 L/m^2, 1 cubic foot @ NTP/square foot = 0.305 m^3 @ NTP/m^2, 1 cubic foot = 0.02832 M^3.

a. Hazardous materials within piping shall not be included in the calculated quantities.

b. Quantity of hazardous materials in a single fabrication shall not exceed the maximum allowable quantities per control area in Tables 307.1(1) and 307.1(2).

c. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.

d. The aggregate quantity of flammable, pyrophoric, toxic and highly toxic gases shall not exceed 9,000 cubic feet at NTP.

e. The aggregate quantity of pyrophoric gases in the building shall not exceed the amounts set forth in Table 415.3.2.

[F] 415.8.2.3 Location of occupied levels. Occupied levels of fabrication areas shall be located at or above the first story above grade plane.

[F] 415.8.2.4 Floors. Except for surfacing, floors within fabrication areas shall be of noncombustible construction.

Openings through floors of fabrication areas are permitted to be unprotected where the interconnected levels are used solely for mechanical equipment directly related to such fabrication areas (see also Section 415.8.2.5).

Floors forming a part of an occupancy separation shall be liquid tight.

[F] 415.8.2.5 Shafts and openings through floors. Elevator shafts, vent shafts and other openings through floors shall be enclosed when required by Section 707. Mechanical, duct and piping penetrations within a fabrication area shall not extend through more than two floors. The annular space around penetrations for cables, cable trays, tubing, piping, conduit or ducts shall be sealed at the floor level to restrict the movement of air. The fabrication area, including the areas through which the ductwork and piping extend, shall be considered a single conditioned environment.

[F] 415.8.2.6 Ventilation. Mechanical exhaust ventilation at the rate of not less than 1 cubic foot per minute per square foot [0.0051 $m^3/(s \cdot m^2)$] of floor area shall be provided throughout the portions of the fabrication area where HPM are used or stored. The exhaust air duct system of one fabrication area shall not connect to another duct system outside that fabrication area within the building.

A ventilation system shall be provided to capture and exhaust gases, fumes and vapors at workstations.

Two or more operations at a workstation shall not be connected to the same exhaust system where either one or the combination of the substances removed could constitute a fire, explosion or hazardous chemical reaction within the exhaust duct system.

Exhaust ducts penetrating occupancy separations shall be contained in a shaft of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate fire walls.

Fire dampers shall not be installed in exhaust ducts.

[F] 415.8.2.7 Transporting hazardous production materials to fabrication areas. HPM shall be transported to fabrication areas through enclosed piping or tubing systems that comply with Section 415.8.6.1, through service corridors complying with Section 415.8.4, or in corridors as permitted in the exception to Section 415.8.3. The handling or transporting of HPM within service corridors shall comply with the *Florida Fire Prevention Code*.

[F] 415.8.2.8 Electrical.

[F] 415.8.2.8.1 General. Electrical equipment and devices within the fabrication area shall comply with Chapter 27 of the *Florida Building Code, Building*. The requirements for hazardous locations need not be applied where the average air change is at least four times that set forth in Section 415.8.2.6 and where the number of air changes at any location is not less than three times that required by Section 415.8.2.6. The use of recirculated air shall be permitted.

[F] 415.8.2.8.2 Workstations. Workstations shall not be energized without adequate exhaust ventilation. See Section 415.8.2.6 for workstation exhaust ventilation requirements.

[F] 415.8.3 Corridors. Corridors shall comply with Chapter 10 and shall be separated from fabrication areas as specified in Section 415.8.2.2. Corridors shall not contain HPM and shall not be used for transporting such materials, except through closed piping systems as provided in Section 415.8.6.3.

Exception: Where existing fabrication areas are altered or modified, HPM is allowed to be transported in existing corridors, subject to the following conditions:

1. Corridors. Corridors adjacent to the fabrication area where the alteration work is to be done shall comply with Section 1017 for a length determined as follows:
   1.1 The length of the common wall of the corridor and the fabrication area; and
   1.2. For the distance along the corridor to the point of entry of HPM into the corridor serving that fabrication area.
2. Emergency alarm system. There shall be an emergency telephone system, a local manual alarm station or other approved alarm-initiating device within corridors at not more than 150-foot (45 720 mm) intervals and at each exit and doorway. The signal shall be relayed to an approved central, proprietary or remote station service or the emergency control station and shall also initiate a local audible alarm.
3. Pass-throughs. Self-closing doors having a fire protection rating of not less than 1 hour shall separate pass-throughs from existing corridors. Pass-throughs shall be constructed as required for the corridors and protected by an approved automatic fire-extinguishing system.

[F] 415.8.4 Service corridors.

[F] 415.8.4.1 Occupancy. Service corridors shall be classified as Group H-5.

[F] 415.8.4.2 Use conditions. Service corridors shall be separated from corridors as required by Section 415.8.2.2. Service corridors shall not be used as a required corridor.

[F] 415.8.4.3 Mechanical ventilation. Service corridors shall be mechanically ventilated as required by Section 415.8.2.6 or at not less than six air changes per hour, whichever is greater.

[F] 415.8.4.4 Means of egress. The maximum distance of travel from any point in a service corridor to an exit, exit access corridor or door into a fabrication area shall not exceed 75 feet (22 860 mm). Dead ends shall not exceed 4 feet (1219 mm) in length. There shall be not less than two exits, and not more than one-half of the required means of egress shall require travel into a fabrication area. Doors from service corridors shall swing in the direction of egress travel and shall be self-closing.

[F] 415.8.4.5 Minimum width. The minimum clear width of a service corridor shall be 5 feet (1524 mm), or 33 inches (838 mm) wider than the widest cart or truck used in the corridor, whichever is greater.

[F] 415.8.4.6 Emergency alarm system. Emergency alarm systems shall be provided in accordance with this section and Sections 414.7.1 and 414.7.2. The maximum allowable quantity per control area provisions shall not apply to emergency alarm systems required for HPM.

[F] 415.8.4.6.1 Service corridors. An emergency alarm system shall be provided in service corridors, with at least one alarm device in each service corridor.

[F] 415.8.4.6.2 Exit access corridors and exit enclosures. Emergency alarms for exit access corridors and exit enclosures shall comply with Section 414.7.2.

[F] 415.8.4.6.3 Liquid storage rooms, HPM rooms and gas rooms. Emergency alarms for liquid storage rooms, HPM rooms and gas rooms shall comply with Section 414.7.1.

[F] 415.8.4.6.4 Alarm-initiating devices. An approved emergency telephone system, local alarm manual pull stations, or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

[F] 415.8.4.6.5 Alarm signals. Activation of the emergency alarm system shall sound a local alarm and transmit a signal to the emergency control station.

[F] 415.8.5 Storage of hazardous production materials.

[F] 415.8.5.1 General. Storage of HPM in fabrication areas shall be within approved or listed storage cabinets or gas cabinets or within a workstation. The storage of HPM in quantities greater than those listed in the *Florida Fire Prevention Code* shall be in liquid storage rooms, HPM rooms or gas rooms as appropriate for the materials stored. The storage of other hazardous materials shall be in accordance with other applicable provisions of this code and the *Florida Fire Prevention Code.*

[F] 415.8.5.2 Construction.

[F] 415.8.5.2.1 HPM rooms and gas rooms. HPM rooms and gas rooms shall be separated from other areas by not less than a 2-hour fire barrier where the area is 300 square feet (27.9 m^2) or more and not less than a 1-hour fire barrier where the area is less than 300 square feet (27.9 m^2).

[F] 415.8.5.2.2 Liquid storage rooms. Liquid storage rooms shall be constructed in accordance with the following requirements:

1. Rooms in excess of 500 square feet (46.5 m^2) shall have at least one exterior door approved for fire department access.
2. Rooms shall be separated from other areas by fire barriers having a fire-resistance rating of not less than 1-hour for rooms up to 150 square feet (13.9 m^2) in area and not less than 2 hours where the room is more than 150 square feet (13.9 m^2) in area.
3. Shelving, racks and wainscoting in such areas shall be of noncombustible construction or wood of not less than 1inch (25 mm) nominal thickness.
4. Rooms used for the storage of Class I flammable liquids shall not be located in a basement.

[F] 415.8.5.2.3 Floors. Except for surfacing, floors of HPM rooms and liquid storage rooms shall be of noncombustible liquid-tight construction. Raised grating over floors shall be of noncombustible materials.

[F] 415.8.5.3 Location. Where HPM rooms, liquid storage rooms and gas rooms are provided, they shall have at least one exterior wall and such wall shall be not less than 30 feet (9144 mm) from lot lines, including lot lines adjacent to public ways.

[F] 415.8.5.4 Explosion control. Explosion control shall be provided where required by Section 414.5.1.

[F] 415.8.5.5 Exits. Where two exits are required from HPM rooms, liquid storage rooms and gas rooms, one shall be directly to the outside of the building.

[F] 415.8.5.6 Doors. Doors in a fire barrier wall, including doors to corridors, shall be self-closing fire door assemblies having a fire-protection rating of not less than $^3/_4$ hour.

[F] 415.8.5.7 Ventilation. Mechanical exhaust ventilation shall be provided in liquid storage rooms, HPM rooms and gas rooms at the rate of not less than 1 cubic foot per minute per square foot (0.044 L/s/m^2) of floor area or six air changes per hour, whichever is greater, for categories of material.

Exhaust ventilation for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding areas and direct the exhaust ventilation to an exhaust system.

[F] 415.8.5.8 Emergency alarm system. An approved emergency alarm system shall be provided for HPM rooms, liquid storage rooms and gas rooms.

Emergency alarm-initiating devices shall be installed outside of each interior exit door of such rooms.

Activation of an emergency alarm-initiating device shall sound a local alarm and transmit a signal to the emergency control station.

An approved emergency telephone system, local alarm manual pull stations or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

[F] 415.8.6 Piping and tubing.

[F] 415.8.6.1 General. Hazardous production materials piping and tubing shall comply with this section and ASME B31.3.

[F] 415.8.6.2 Supply piping and tubing.

[F] 415.8.6.2.1 HPM having a health-hazard ranking of 3 or 4. Systems supplying HPM liquids or gases having a health-hazard ranking of 3 or 4 shall be welded throughout, except for connections, to the systems that are within a ventilated enclosure if the material is a gas, or an approved method of drainage or containment is provided for the connections if the material is a liquid.

[F] 415.8.6.2.2 Location in service corridors. Hazardous production materials supply piping or tubing in service corridors shall be exposed to view.

[F] 415.8.6.2.3 Excess flow control. Where HPM gases or liquids are carried in pressurized piping above 15 pounds per square inch gauge (psig) (103.4 kPa), excess flow control shall be provided. Where the piping originates from within a liquid storage room, HPM room or gas room, the excess flow control shall be located within the liquid storage room, HPM room or gas room. Where the piping originates from a bulk source, the excess flow control shall be located as close to the bulk source as practical.

[F] 415.8.6.3 Installations in corridors and above other occupancies. The installation of HPM piping and tubing within the space defined by the walls of corridors and the floor or roof above, or in concealed spaces above other occupancies, shall be in accordance with Section 415.8.6.2 and the following conditions:

1. Automatic sprinklers shall be installed within the space unless the space is less than 6 inches (152 mm) in the least dimension.
2. Ventilation not less than six air changes per hour shall be provided. The space shall not be used to convey air from any other area.
3. Where the piping or tubing is used to transport HPM liquids, a receptor shall be installed below such piping or tubing. The receptor shall be designed to collect any discharge or leakage and drain it to an approved location. The 1-hour enclosure shall not be used as part of the receptor.
4. HPM supply piping and tubing and nonmetallic waste lines shall be separated from the corridor and from occupancies other than Group H-5 by fire barriers that have a fire-resistance rating of not less than 1 hour. Where gypsum wallboard is used, joints on the piping side of the enclosure are not required to be taped, provided the joints occur over framing members. Access openings into the enclosure shall be protected by approved fire protection-rated assemblies.
5. Readily accessible manual or automatic remotely activated fail-safe emergency shutoff valves shall be installed on piping and tubing other than waste lines at the following locations:

   5.1. At branch connections into the fabrication area.

   5.2. At entries into corridors.

   Exception: Transverse crossings of the corridors by supply piping that is enclosed within a ferrous pipe or tube for the width of the corridor need not comply with Items 1 through 5.

[F] 415.8.6.4 Identification. Piping, tubing and HPM waste lines shall be identified in accordance with ANSI A13.1 to indicate the material being transported.

[F] 415.8.7 Continuous gas detection systems. A continuous gas detection system shall be provided for HPM gases when the physiological warning threshold level of the gas is at a higher level than the accepted PEL for the gas and for flammable gases in accordance with this section.

[F] 415.8.7.1 Where required. A continuous gas-detection system shall be provided in the areas identified in Sections 415.8.7.1.1 through 415.8.7.1.4.

[F] 415.8.7.1.1 Fabrication areas. A continuous gas-detection system shall be provided in fabrication areas when gas is used in the fabrication area.

[F] 415.8.7.1.2 HPM rooms. A continuous gas-detection system shall be provided in HPM rooms when gas is used in the room.

[F] 415.8.7.1.3 Gas cabinets, exhausted enclosures and gas rooms. A continuous gas-detection system shall be provided in gas cabinets and exhausted enclosures. A continuous gas-detection system shall be provided in gas rooms when gases are not located in gas cabinets or exhausted enclosures.

[F] 415.8.7.1.4 Corridors. When gases are transported in piping placed within the space defined by the walls of a corridor and the floor or roof above the corridor, a continuous gas-detection system shall be provided where piping is located and in the corridor.

Exception: A continuous gas-detection system is not required for occasional transverse crossings of the corridors by supply piping that is enclosed in a ferrous pipe or tube for the width of the corridor.

[F] 415.8.7.2 Gas-detection system operation. The continuous gas-detection system shall be capable of monitoring the room, area or equipment in which the gas is located at or below the PEL or ceiling limit of the gas for which detection is provided. For flammable gases, the monitoring detection threshold level shall be vapor concentrations in excess of 20 percent of the lower explosive limit (LEL). Monitoring for highly toxic and

toxic gases shall also comply with the requirements for such material in the *Florida Fire Prevention Code*.

[F] 415.8.7.2.1 Alarms. The gas detection system shall initiate a local alarm and transmit a signal to the emergency control station when a short-term hazard condition is detected. The alarm shall be both visual and audible and shall provide warning both inside and outside the area where the gas is detected. The audible alarm shall be distinct from all other alarms.

[F] 415.8.7.2.2 Shutoff of gas supply. The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for which gas is detected when a short-term hazard condition is detected. Automatic closure of shutoff valves shall comply with the following:

1. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a room and compressed gas containers are not in gas cabinets or an exhausted enclosure, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve supplying the manifold for the compressed gas container of the specific gas detected shall automatically close.

Exception: Where the gas-detection sampling point initiating the gas detection system alarm is at the use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve for the branch line located in the piping distribution manifold enclosure shall automatically close.

[F] 415.8.8 Manual fire alarm system. An approved manual fire alarm system shall be provided throughout buildings containing Group H-5. Activation of the alarm system shall initiate a local alarm and transmit a signal to the emergency control station. The fire alarm system shall be designed and installed in accordance with Section 907.

415.8.9 Emergency control station. An emergency control station shall be provided in accordance with Sections 415.8.9.1 through 415.8.9.3.

415.8.9.1 Location. The emergency control station shall be located on the premises at an approved location outside the fabrication area.

415.8.9.2 Staffing. Trained personnel shall continuously staff the emergency control station.

415.8.9.3 Signals. The emergency control station shall receive signals from emergency equipment and alarm and detection systems. Such emergency equipment and alarm and detection systems shall include, but not be limited to, the following where such equipment or systems are required to be provided either in this chapter or elsewhere in this code:

1. Automatic fire sprinkler system alarm and monitoring systems.
2. Manual fire alarm systems.
3. Emergency alarm systems.
4. Continuous gas-detection systems.
5. Smoke detection systems.
6. Emergency power system.
7. Automatic detection and alarm systems for pyrophoric liquids and Class 3 water-reactive liquids required in the *Florida Fire Prevention Code*.
8. Exhaust ventilation flow alarm devices for pyrophoric liquids and Class 3 water-reactive liquids cabinet exhaust ventilation systems required in the *Florida Fire Prevention Code*.

[F] 415.8.10 Emergency power system. An emergency power system shall be provided in Group H-5 occupancies where required in Section 415.8.10.1. The emergency power system shall be designed to supply power automatically to required electrical systems when the normal electrical supply system is interrupted.

[F] 415.8.10.1 Required electrical systems. Emergency power shall be provided for electrically operated equipment and connected control circuits for the following systems:

1. HPM exhaust ventilation systems.
2. HPM gas cabinet ventilation systems.
3. HPM exhausted enclosure ventilation systems.
4. HPM gas room ventilation systems.
5. HPM gas detection systems.
6. Emergency alarm systems.
7. Manual fire alarm systems.
8. Automatic sprinkler system monitoring and alarm systems.
9. Automatic alarm and detection systems for pyrophoric liquids and Class 3 water-reactive liquids required in the *Florida Fire Prevention Code*.
10. Flow alarm switches for pyrophoric liquids and Class 3 water-reactive liquids cabinet exhaust ventilation systems required in the *Florida Fire Prevention Code*.
11. Electrically operated systems required elsewhere in this code or in the *Florida Fire Prevention Code* applicable to the use, storage or handling of HPM.

[F] 415.8.10.2 Exhaust ventilation systems. Exhaust ventilation systems are allowed to be designed to operate at not less than one-half the normal fan speed on the emergency power system where it is demonstrated that the level of exhaust will maintain a safe atmosphere.

[F] 415.8.11 Automatic sprinkler system protection in exhaust ducts for HPM.

[F] 415.8.11.1 Exhaust ducts for HPM. An approved automatic sprinkler system shall be provided in exhaust ducts conveying gases, vapors, fumes, mists or dusts generated from HPM in accordance with this section and the *Florida Building Code, Mechanical*.

[F] 415.8.11.2 Metallic and noncombustible nonmetallic exhaust ducts. An approved automatic sprinkler system shall be provided in metallic and noncombustible nonmetallic exhaust ducts when all of the following conditions apply:

1. Where the largest cross-sectional diameter is equal to or greater than 10 inches (254 mm).
2. The ducts are within the building.
3. The ducts are conveying flammable gases, vapors or fumes.

[F] 415.8.11.3 Combustible nonmetallic exhaust ducts. Automatic sprinkler system protection shall be provided in combustible nonmetallic exhaust ducts where the largest cross-sectional diameter of the duct is equal to or greater than 10 inches (254 mm).

Exceptions:

1. Ducts listed or approved for applications without automatic fire sprinkler system protection.
2. Ducts not more than 12 feet (3658 mm) in length installed below ceiling level.

[F] 415.8.11.4 Automatic sprinkler locations. Sprinkler systems shall be installed at 12-foot (3658 mm) intervals in horizontal ducts and at changes in direction. In vertical ducts, sprinklers shall be installed at the top and at alternate floor levels.

SECTION 416
APPLICATION OF FLAMMABLE FINISHES

[F] 416.1 General. The provisions of this section shall apply to the construction, installation and use of buildings and structures, or parts thereof, for the spraying of flammable paints, varnishes and lacquers or other flammable materials or mixtures or compounds used for painting, varnishing, staining or similar purposes. Such construction and equipment shall comply with the *Florida Fire Prevention Code*.

[F] 416.2 Spray rooms. *Spray rooms shall be enclosed with fire barriers with not less than a 1-hour fire-resistance rating. Floors shall be waterproofed and drained in an approved manner.*

[F] 416.2.1 Surfaces. The interior surfaces of spray rooms shall be smooth and shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning, and shall be so designed to confine residues within the room. Aluminum shall not be used.

[F] 416.3 Spraying spaces. Spraying spaces shall be ventilated with an exhaust system to prevent the accumulation of flammable mist or vapors in accordance with the *Florida Building Code, Mechanical*. Where such spaces are not separately enclosed, noncombustible spray curtains shall be provided to restrict the spread of flammable vapors.

[F] 416.3.1 Surfaces. The interior surfaces of spraying spaces shall be smooth and continuous without edges; shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning; and shall be so designed to confine residues within the spraying space. Aluminum shall not be used.

[F] 416.4 Fire protection. An automatic fire-extinguishing system shall be provided in all spray, dip and immersing spaces and storage rooms and shall be installed in accordance with Chapter 9.

SECTION 417
DRYING ROOMS

[F] 417.1 General. A drying room or dry kiln installed within a building shall be constructed entirely of approved noncombustible materials or assemblies of such materials regulated by the approved rules or as required in the general and specific sections of Chapter 4 for special occupancies and where applicable to the general requirements of Chapter 28.

[F] 417.2 Piping clearance. Overhead heating pipes shall have a clearance of not less than 2 inches (51 mm) from combustible contents in the dryer.

[F] 417.3 Insulation. Where the operating temperature of the dryer is 175°F (79°C) or more, metal enclosures shall be insulated from adjacent combustible materials by not less than 12 inches (305 mm) of airspace, or the metal walls shall be lined with $^1/_4$-inch (6.35 mm) insulating mill board or other approved equivalent insulation.

[F] 417.4 Fire protection. Drying rooms designed for high-hazard materials and processes, including special occupancies as provided for in Chapter 4, shall be protected by an approved automatic fire-extinguishing system complying with the provisions of Chapter 9.

SECTION 418
ORGANIC COATINGS

[F] 418.1 Building features. Manufacturing of organic coatings shall be done only in buildings that do not have pits or basements.

[F] 418.2 Location. Organic coating manufacturing operations and operations incidental to or connected therewith shall not be located in buildings having other occupancies.

[F] 418.3 Process mills. Mills operating with close clearances and that process flammable and heat-sensitive materials, such as nitrocellulose, shall be located in a detached building or noncombustible structure.

[F] 418.4 Tank storage. Storage areas for flammable and combustible liquid tanks inside of structures shall be located at or above grade and shall be separated from the processing area by not less than 2-hour fire barriers.

[F] 418.5 Nitrocellulose storage. Nitrocellulose storage shall be located on a detached pad or in a separate structure or a room enclosed with no less than 2-hour fire barriers.

[F] 418.6 Finished products. Storage rooms for finished products that are flammable or combustible liquids shall be separated from the processing area by fire barriers having a fire-resistance rating of at least 2 hours, and openings in the walls shall be protected with approved opening protectives.

SECTION 419
HOSPITALS

419.1 Scope.

419.1.1 Hospitals shall comply with all applicable requirements of the code and the following design and construction standards as described herein and shall have plans reviewed and construction surveyed by the state agency authorized to do so by Chapter 553.80(1)(c), *Florida Statutes*.

Note: For project submission and fee requirements, codes and standards for existing facilities, and other administrative, licensure and programmatic provisions for hospitals, see Agency for Health Care Administration [AHCA] Chapter 59A-3, *Florida Administrative Code* and Chapter 395, *Florida Statutes*.

419.2 Codes and standards for the design and construction of general, rehabilitative, and psychiatric hospitals, including Intensive Residential Treatment Facilities (IRTF) for children and adolescents.

419.2.1 Except as modified and required by this section of the code, *Chapter 59A-3 Florida Administrative Code*, or by Chapter 395, *Florida Statutes*, all new hospitals, as listed in Section 419.2 of the code, all outpatient facilities of hospitals, and all projects, as described in Section 105 of the code, to these existing hospitals, shall also be in compliance with the following codes and standards on the effective date of the code:

419.2.1.1 The fire codes described in Chapter 69A-53, *Uniform Fire Safety Standards for Hospitals and Nursing Homes, Florida Administrative Code*.

419.2.1.2 The Guidelines for Design and Construction of Health Care Facilities (The Guidelines), Part I - General, Part 2 - Hospitals, and Part 3 - Ambulatory Care Facilities, incorporated by reference and obtainable from the American Institute of Architects, 1735 New York Ave., N.W., Washington, D.C. 20006-5292.

419.2.1.3 *Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, Sheet Metal and Air Conditioning Contractors National Association, Inc.* (SMACNA).

419.3 Additional physical plant requirements for general, rehabilitation, and psychiatric hospitals, including Intensive Residential Treatment Facilities (IRTF) for children and adolescents.

419.3.1 In addition to the codes and standards referenced in Section 419.2 of the code, the following minimum standards of construction and specified minimum essential facilities, shall apply to all new hospitals, as listed in Section 419.3 of the code, all additions, alterations or renovations to these existing hospitals and to outpatient facilities owned or operated by these hospitals as described in Chapter 395.0163, *Florida Statutes*, on the effective date of the code.

419.3.2 Critical care units. (Reference The Guidelines for other requirements.)

419.3.2.1 Toileting facilities are required for each critical care patient. When portable or under cabinet modular toilets are utilized in lieu of individual toilet rooms, provisions shall be made for user privacy, and the storage, servicing and odor control of these toilet units. Permanently installed toilet fixtures located inside of the critical care room shall not be permitted.

419.3.2.2 Sliding doors used for access to critical care rooms may be either manual or power operated and shall be smoke resistive if located on an exit access corridor.

419.3.3 Newborn intensive care units. Reference The Guidelines for other requirements.)

419.3.3.1 General categories of neonatal services in the State of Florida are Level I, newborn nursery; Level II, intermediate care unit; and Level III, intensive care unit. Facilities which offer obstetrical services shall provide at a minimum a Level I newborn nursery or a holding nursery that shall meet the requirements of The Guidelines, and facilities that offer neonatal care for Level II and Level III neonatal services shall meet the requirements of The Guidelines for a newborn intensive care unit.

419.3.3.2 In facilities that provide labor/delivery/ recovery (LDR) rooms with postpartum bedrooms with rooming-in capabilities or labor/delivery/ recovery/postpartum (LDRP) rooms, a full-term or Level I nursery is not required. In that case, a baby holding nursery shall be provided and shall meet the requirements of The Guidelines.

419.3.4 Mobile testing and treatment facilities.

419.3.4.1 In addition to any other state of Florida required permits, mobile facilities shall be approved in advance by the Agency for Health Care Administration before they may be utilized for patient services.

419.3.4.2 When the mobile facility is located in a roadway or a parking lot, there shall be sturdy walls, fences or bollards around the immediate site to prevent collisions with the unit by other vehicles

419.3.4.3 Electrical connection to the hospital electrical system shall be permitted only when the mobile facility complies with appropriate requirements of the *Florida Building Code, Building*.

419.3.4.4 There shall be a rain-free passage from the hospital to the entrance to the mobile facility.

419.3.4.5 A fire alarm system shall be provided. An alarm initiated in the mobile facility shall activate the hospital sys-

tem at the 24-hour staffed location, and a fire alarm signal in the hospital shall sound an alarm in the mobile facility.

419.3.4.6 The mobile facility shall not diminish egress from the hospital.

419.3.4.7 There shall be a telephone located inside the mobile facility connected to the hospital communication system.

419.3.4.8 When units provide critical care procedures, there shall be a code blue station in the unit connected to the hospital response team.

419.3.4.9 The electrical systems in the mobile facility shall comply with the requirements of the *Florida Building Code, Building*, The Guidelines and with Section 419.3.15 of the code for the type of service to be provided.

419.3.4.10 The mechanical systems in the mobile facility shall comply with the requirements of the *Florida Building Code, Mechanical*, The Guidelines and with Section 419.3.11 of the code.

419.3.5 Outpatient surgery. Reserved.

419.3.6 Obstetrical facilities. Reserved.

419.3.7 Administration and public areas. Reserved.

419.3.8 Mobile testing and treatment facilities. Reserved.

419.3.9 Details and finishes. (See The Guidelines for other requirements.)

419.3.9.1 Each patient sleeping room shall be provided with a window that shall have a minimum 20-foot (6 m) unobstructed vista measured perpendicularly from the plane of the window.

419.3.9.2 Ceilings in rooms with ceiling-mounted surgical light fixtures and in kitchens shall be a minimum height of 9 feet (2.7 m).

419.3.9.3 Soap dispensers shall be provided at all hand washing facilities. If soap dishes are used, only fully recessed soap dishes shall be permitted in patient tubs or showers.

419.3.9.4 Toilet compartment partitions and urinal screens in the men's toilet rooms shall not be constructed of enameled steel.

419.3.9.5 All smoke partitions, horizontal exits and exit passageway partitions shall be constructed prior to the construction of intervening walls.

419.3.9.6 Smoke partitions shall be constructed so as to provide a continuous smoke-tight membrane from exterior wall to exterior wall and from the floor to the underside of the deck above. This includes interstitial space and the area above solid fire tested membranes.

419.3.9.7 Where it is not possible to inspect fire/smoke partitions because of the fire-tested membrane, fire-rated access panels shall be installed adjacent to each side of the smoke partitions at intervals not exceeding 30 feet (9 m) and in such locations as necessary to view all surfaces of the partition. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings shall be effectively and permanently identified with signs or stenciling. Such identification shall be above any decorative ceiling and in concealed spaces. Suggested wording for a fire/smoke partition is as follows: "FIRE AND SMOKE BARRIER – PROTECT ALL OPENINGS."

419.3.9.8 Where electrical conduits, cable trays, ducts and utility pipes pass through the smoke partition, the utilities shall be located so that access is maintained to adjacent wall surfaces and to all damper access panels. The details shall show the studs and reinforcing half studs so that proper support is provided for the wall surfacing material. There shall be a minimum clearance of 6 inches (152 mm) between all conduits, piping and duct work that are parallel or adjacent to all fire and fire/smoke rated walls to facilitate the inspection of these walls.

419.3.9.9 The use of sliding or folding doors to patient use toilet, baths, or showers shall not be permitted.

419.3.10 Elevators where required. (See The Guidelines for other requirements.) All elevators shall be in compliance with the requirements of Chapter 30 of the *Florida Building Code, Building* and Chapter 69A-47, *Florida Administrative Code*, "Uniform Fire Safety Standards for Elevators."

419.3.11 Heating, ventilating and air-conditioning systems. (See Section 7.31 of The Guidelines for other requirements.)

419.3.11.1 Air-handling equipment shall be located in mechanical equipment rooms unless it serves only one room and it is located in that room.

419.3.11.2 Ventilation shall be provided by mechanical means in all rooms in new facilities and in all remodeled rooms.

419.3.11.3 Rooms requiring positive or negative relative pressures, shall maintain the air quantities as required between the supply, return or exhaust at a minimum of 75 cfm (2.13 m^3/min.) for room areas 100 square feet (929 m^2) or larger and 50 cfm (1.42 m^3/min) for rooms less than 100 square feet (929 m^2).

419.3.11.4 All new hospital, outpatient surgery and cardiac catheterization facility construction shall have completely ducted air supply, return, outside air and exhaust systems. In buildings with multiple uses, tenants or occupancies, the licensed health care areas shall be served by separate ducted mechanical air supply, return and exhaust systems.

419.3.11.5 In new construction, horizontal offsets of duct system risers penetrating more than one floor shall not be allowed.

419.3.11.6 Flexible duct work shall have a continuous metal inner liner encased by insulating material with an outer vapor jacket conforming to UL 181 unless the flexible duct meets the following criteria:

- The duct conforms to UL Class 1 Air Duct, Standard 181 with minimum rated air velocity of 4,000 feet per minute, and is pressure rated for a minimum of 4-inches water gage positive pressure and 1-inch water gage negative pressure.

- The inner core of the duct is constructed of Chlorinated Polyethylene (CPE) material encircling a steel helix bonded to the CPE.
- The duct has a fire-retardant metalized vapor barrier that is reinforced with crosshatched fiberglass scrim having a permanence of not greater than 0.05 perms when tested in accordance with ASTM E 96 Procedure A.
- The duct has passed an impact test equal to the UL 181 standard, conducted by a nationally recognized testing laboratory (NRTL) except it shall use a 25-pound weight dropped from a height of 10 feet. As a result of the test, the inner and outer surfaces of the sample shall not have ruptured, broken, torn, ripped, collapsed or separated in order for the duct to pass the test. In addition, the helix shall rebound to a cross-sectional elliptical area not less than 80 percent of the original test sample diameter.

The use of flexible duct shall be limited to flexible air connector applications.

419.3.11.7 Variable air volume systems shall not be permitted for use in surgical departments, obstetrical departments, laboratories, isolation rooms and critical care units and rooms.

419.3.11.8 Filter housing frame blank-off panels shall be permanently attached to the frame, constructed of rigid materials and have sealing surfaces equal to or greater than the filter media installed in the filter frame.

419.3.11.9 Each air handling unit filter rated in excess of 1,000 cfm (28.32 m^3/min) capacity shall be equipped with a differential pressure gauge. The range of acceptable operation shall be clearly and permanently indicated on the gauge face or display. Multiple bank filter assemblies shall be equipped with a gauge for each filter media bank.

419.3.12 Fan and damper control during fire alarm.

419.3.12.1 During a fire alarm, fan systems and fan equipment serving more than one room shall be stopped to prevent the movement of smoke by mechanical means from the zone in alarm to adjacent smoke zones.

419.3.12.2 Fan control shall be designed so as to minimize the interruption of heating, ventilating and air conditioning in compartments remote from the compartment in alarm.

419.3.12.3 Fan control shall not interfere with the continuous operation of exhaust systems conveying ethylene oxide or other hazardous chemicals and fumes or systems required to operate continuously for the health and safety of occupants. Such systems shall include fume hood exhaust deemed by the governing body of the hospital to present a hazard to occupants if exhaust airflow is stopped. Air-handling systems shall be designed to allow for continuous operation of all such systems and to minimize movement of smoke by mechanical means from the zone in alarm.

419.3.13 Plumbing. (See Section 7.31.E of The Guidelines for other requirements.)

419.3.13.1 All plumbing systems shall be designed and installed in accordance with the *Florida Building Code, Plumbing*.

419.3.13.2 Grease interceptors shall be located outside of the building.

419.3.13.3 Wall-mounted lavatories and hand-washing facilities shall be attached to floor-mounted carriers and shall withstand an applied vertical load of a minimum of 250 pounds (114 kg) on the front of the fixture.

419.3.14 Fire pump. Where required in new construction, fire pumps and ancillary equipment shall be separated from other functions by construction having a 2-hour fire-resistance rating.

419.3.14.1 The fire pump normal service disconnect shall be rated to hold locked rotor current indefinitely. If the approved normal service disconnect is located on the exterior, it shall be supervised by connection to the fire pump remote annunciator and shall provide a separate fire alarm system trouble indication.

419.3.14.2 When the fire pump is placed on the emergency system in addition to the normal supply, the emergency feeder protective device shall be sized in accordance with maximum rating or settings of Chapter 27 of the *Florida Building Code, Building*.

419.3.14.3 The fire pump transfer switch may be either manual or automatic. If located on the line side of the controller as a separate unit, the switch must be rated for the pump motor locked rotor current indefinitely and must be located in the pump room.

419.3.14.4 Combination fire pump controller and transfer switch units listed by the Underwriter's Laboratories, Inc., as prescribed by Chapter 27 of the *Florida Building Code, Building* are acceptable when the transfer switch has exposable and replaceable contacts, not circuit breaker types, rated for the available short-circuit current.

419.3.14.5 The fire pump shall be installed in a readily accessible location. When it is located on the grade level floor, there shall be direct access from the exterior.

419.3.15 Electrical requirements. (See The Guidelines for other requirements.) All material, including equipment, conductors, controls, and signaling devices, shall be installed to provide a complete electrical system with the necessary characteristics and capacity to supply the electrical facility requirements as shown in the specifications and as indicated on the plans. All materials and equipment shall be factory listed as complying with applicable standards of Underwriter's Laboratories, Inc. or other similarly established standards of a nationally recognized testing laboratory (NRTL) that has been certified by the Occupational Safety and Health Administration (OSHA) for that referenced standard.

419.3.15.1 Nonmetallic sheathed cable or similar systems are not permitted for power and lighting wiring in any facility.

419.3.15.2 Panel boards located in spaces subject to storage shall have the clear working space per Chapter 27, *Florida Building Code, Building*. "ELECTRICAL ACCESS - NOT FOR STORAGE" shall be permanently marked on the floor and wall about the panel. Panel boards shall not be located in egress corridors.

419.3.15.3 There shall be documentation for equipotential grounding in all patient care areas, building service ground electrode systems, lightning protection ground terminals and special systems such as fire alarm, nurse call, paging, generator, emergency power, fault analysis and breaker coordination.

419.3.15.4 All spaces occupied by people, machinery and equipment within buildings and approaches to buildings shall have electric lighting.

419.3.15.5 Operating rooms and delivery rooms shall have general lighting for the room in addition to local high intensity, specialized lighting provided by special fixtures at the surgical and obstetrical tables. Each special lighting unit for local lighting at the tables shall be connected to an independent circuit and shall be powered from the critical branch. A minimum of one general purpose lighting fixture shall be powered from a normal circuit in an operating room, delivery or similar room.

419.3.15.6 There shall be a maximum of six duplex receptacles on a circuit in general patient care areas.

419.3.15.7 Duplex receptacles in critical care areas, in all emergency treatment rooms or areas, and other areas including, angiographic laboratories, cardiac catheterization laboratories, coronary care units, hemodialysis rooms or areas, human physiology laboratories, intensive care units and postoperative recovery rooms, shall be provided as follows:

419.3.15.7.1 There shall be a minimum of six duplex electrical receptacles for each patient station.

419.3.15.7.2 Four shall be connected to the critical branch of the essential electrical system, and two of the required number shall be connected to dedicated circuits.

419.3.15.7.3 Two shall be connected to a normal power circuit except in anesthetizing locations where two shall be connected to critical power circuits.

419.3.15.7.4 There shall be no more than two receptacles per circuit.

419.3.15.8 All receptacles shall have engraved cover plates to indicate the panel board and circuit numbers powering the device.

419.3.15.9 Branch circuit over-current devices shall be readily accessible to nursing staff and other authorized personnel.

419.3.16 Fire alarm systems. A fire alarm annunciator panel shall be provided at a 24-hour monitored location. The panel shall indicate the zone of actuation of the alarm, and there shall be a trouble signal indicator. Each smoke compartment shall be annunciated as a separate fire alarm zone. A fire alarm system zone shall not include rooms or spaces in other smoke compartments and shall be limited to a maximum area of 22,500 square feet (2090 m^2).

419.3.17 Nurse call system. (See Section 7.32.G of The Guidelines for other requirements.) A nurse call system shall be provided that will register a call from each patient bed to the nurse station and activate a visual signal at the patient room door and activate a visual and audible signal in the clean workroom, the soiled workroom, the nourishment station and the master station of the nursing unit. In multicorridor nursing units, additional visible signals shall be installed at corridor intersections in the vicinity of nurse stations. In rooms containing two or more calling stations, indicating lights shall be provided for each calling station.

419.3.17.1 Master staff and duty stations may include volume controls, provided the minimum setting provides audibility of 15 decibels above normal ambient noise levels where the station is located.

419.3.17.2 An emergency calling station of the pull cord type shall be provided and shall be conveniently located for patient use in each patient toilet, bath or shower room, but not inside the shower. The call signal shall be cancelled only at the emergency calling station. The emergency station shall activate distinctive audible and visual signals immediately.

419.3.17.3 An emergency resuscitation alarm (Code Blue) calling station shall be provided for staff use in each operating, delivery, recovery LDR, LDRP, emergency, cardiac and intensive nursing care rooms, nurseries and similar rooms.

419.3.17.4 Emergency resuscitative alarm panels (centralized Code Blue) shall be provided at the attending nurse station and at other locations as determined by the facility that are staffed 24 hours per day. Audible signals may be silenced temporarily for a call provided subsequent calls automatically reactivate the audible signal immediately. The alarm panel at the 24-hour staffed station may indicate the nurse station/suite where the call originated in lieu of identifying the bed only when a 24-hour station is not one and the same as the attending nurse station.

419.3.18 Emergency electric service. A Type 1 essential electrical system shall be provided in all hospitals as described in NFPA 99, *Health Care Facilities*. The emergency power for this system shall meet the requirements of a Level 1, Type 10, Class 48 generator as described in NFPA 110, *Emergency Standby Power Systems*.

419.3.18.1 In new construction, the normal main service equipment shall be separated from the emergency distribution equipment by locating it in a separate room. Transfer switches shall be considered emergency distribution equipment for this purpose.

419.3.18.2 Switches for critical branch lighting shall be totally separate from normal switching. The devices or cover plates shall be of a distinctive color. Critical branch switches may be adjacent to normal switches. Switches for life safety lighting are not permitted except as

required for dusk-to-dawn automatic control of exterior lighting fixtures.

419.3.18.3 There shall be selected life safety lighting provided at a minimum of 1 footcandle (10 lux) and designed for automatic dusk-to-dawn operation along the travel paths from the exits to the public way or to safe areas located a minimum of 30 feet (9.144 m) from the building.

419.3.18.4 A minimum of one elevator per bank serving any patient use floor shall be connected to the equipment branch of the essential electric system and arranged for manual or automatic operation during loss of normal power.

419.3.18.5 If a day tank is provided, it shall be equipped with a dedicated low level fuel alarm and a manual pump. The alarm shall be located at the generator derangement panel.

419.3.18.6 Transfer switch contacts shall be of the open type and shall be accessible for inspection and replacement.

419.3.18.7 If required by the facility's emergency food plan, there shall be power connected to the equipment branch of the essential electrical system for kitchen refrigerators, freezers and range hood exhaust fans. Selected lighting within the kitchen and dry storage areas shall be connected to the critical branch of the essential electrical system.

419.3.18.8 Outpatient surgery units which are located in a separate building or on another campus shall have a Type 1 essential electrical system in compliance with NFPA 99, *Health Care Facilities*. The emergency power for this system shall meet the requirements of a Level 1, Type 10, Class 8 generator as described in NFPA 110, *Emergency Standby Power System.*

419.3.19 Lightning protection. A lightning protection system shall be provided for all new buildings and additions in accordance with NFPA 780, *Installation of Lightning Protection Systems.*

419.3.19.1 Where additions are constructed to existing buildings, the existing building's lightning protection system, if connected to the new lightning protection system, shall be inspected and brought into compliance with current standards.

419.3.19.2 A lightning protection system shall be installed on all buildings in which outpatient surgical procedures are provided.

419.3.19.3 There shall be surge protection for all normal and emergency electrical services.

419.3.19.4 Additional surge protection shall be provided for all low voltage and power connections to all electronic equipment in critical care areas and life safety systems and equipment such as fire alarm, nurse call and other critical systems. Protection shall be in accordance with appropriate IEEE Standards for the type of equipment protected.

419.3.19.5 All low-voltage system main or branch circuits entering or exiting the structure shall have surge suppressors installed for each pair of conductors and shall have visual indication for protector failure to the maximum extent feasible.

419.4 Physical plant requirements for disaster preparedness of new hospital construction.

419.4.1 Definitions. The following definitions shall apply specifically to all new facilities as used herein:

419.4.1.1 "New facility" means a hospital which has not received a Stage II Preliminary Plan approval from the Agency for Health Care Administration pursuant to this section.

419.4.1.2 "Net square footage" means the clear floor space of an area excluding cabinetry and other fixed furniture or equipment;

419.4.1.3 "During and immediately following" means a period of 72 hours following the loss of normal support utilities to the facility.

419.4.1.4 "Occupied patient area(s)" means the location of patients inside of the new facility or in the addition of a wing or floor to an existing facility during and immediately following a disaster. If these patients are to be relocated into an area of the existing facility during and immediately following a disaster, then for purposes of this code, that location will be defined as the "occupied patient area."

419.4.1.5 "Patient support area(s)" means the area(s) required to ensure the health, safety and well-being of patients during and immediately following a disaster, such as a nursing station, clean and soiled utility areas, food preparation area, and other areas as determined by the facility to be kept operational during and immediately following a disaster.

419.4.1.6 "On-site" means either in, immediately adjacent to, or on the campus of the facility, or addition of a wing or floor to an existing facility.

419.4.2 Disaster preparedness construction standards. The following construction standards are in addition to the physical plant requirements described in Sections 419.2 through 419.3. These minimum standards are intended to increase the ability of the facility to be structurally capable of serving as a shelter for patients, staff and the family of patients and staff and equipped to be self-supporting during and immediately following a disaster.

419.4.2.1 Space standards.

419.4.2.1.1 For planning purposes, each new facility shall provide a minimum of 30 net square feet (2.79 m^2) per patient served in the occupied patient area(s). The number of patients to be served is to be determined by the facility administrator.

419.4.2.1.2 As determined by the facility, space for administrative and support activities shall be provided for use by facility staff to allow for care of patients in the occupied patient area(s).

419.4.2.1.3 As determined by the facility, space shall be provided for staff and family members of patients and staff.

419.4.2.2 Site standards.

419.4.2.2.1 All new facilities and additions to existing facilities shall be located above the 100-year flood plain or hurricane Category 3 (Saffir-Simpson scale) hurricane surge inundation elevation, whichever requires the highest elevation; or

419.4.2.2.2 The floor elevation of all new occupied patient area(s) and all patient support area(s) and patient support utilities, including mechanical, electrical (except fuel storage as noted in Section 419.4.2.9.3 of this code) and food services shall be located above the 100-year flood plain or hurricane Category 3 (Saffir-Simpson scale) hurricane surge inundation elevations, whichever requires the highest elevation.

419.4.2.2.3 New additions or floors added to existing facilities, as determined by their site locations, shall meet either the requirements of Section 419.4.2.2.1 or 419.4.2.2.2 of this Code, or be so designed and constructed as to be in compliance with the current standards of the National Flood Insurance Program of the Federal Emergency management Agency, incorporated by reference and available from Federal Emergency management Agency, Federal Insurance Administration, Attn. Publications, P.O. Box 70274, Washington, D.C. 20024.

419.4.2.2.4 Where an off-site public access route is available to the new facility at or above the 100-year flood plain, a minimum of one on-site emergency access route shall be provided that is located at the same elevation as the public access route.

419.4.2.2.5 New landscaping elements shall be located so if damaged they will not block the on-site emergency access route to the facility. Outdoor signs and their foundations shall be designed to meet the wind load criteria of the *Florida Building Code, Building*.

419.4.2.2.6 New light standards and their foundations used for lighting the on-site emergency access route shall be designed to meet the wind load criteria of the American Society of Civil Engineers (ASCE 7), 50-year recurrence interval of wind velocity with appropriate exposure category dependent on site location.

419.4.2.3 Structural standards. Wind load design of the building structure and exterior envelope including exterior wall systems shall be designed in accordance with the code.

419.4.2.4 Roofing standards.

419.4.2.4.1 Roofing membrane material shall resist the uplift forces specified in the code. Roof coverings shall be installed according to the specifications provided by the manufacturer.

419.4.2.4.2 Loose-laid ballasted roofs shall not be permitted.

419.4.2.4.3 All new roof appendages such as ducts, tanks, ventilators, receivers, dx condensing units and decorative mansard roofs and their attachment systems shall be structurally engineered to meet the wind load requirements of the applicable building code. All of these attachment systems shall be connected directly to the underlying roof structure or roof support structure.

419.4.2.5 Exterior unit standards.

419.4.2.5.1 All exterior window units, skylights, exterior louvers and exterior door units including vision panels and their anchoring systems shall be designed to resist the wind load requirements of the code and the debris impact requirements in Sections 1626.2 through 1626.4.

419.4.2.5.2 Permanently attached protective systems such as shutters and baffling shall be designed to meet the wind load requirements of this code and the debris impact requirements as specified in Sections 1626.2 through 1626.4.

419.4.2.5.3 Removable protective systems designed to intricately fit with the wall/window system of the facility and stored on-site at the facility and that meet the wind load requirements of the code, and debris impact requirements of Sections 1626.2 through 1626.4 may be used to protect the exterior units.

419.4.2.5.4 All anchoring and attachment to the building of both the permanently attached and removable protective systems shall be designed to meet wind load requirements of the code, and impact requirements of Sections 1626.2 through 1626.4. These designs shall be signed, sealed and dated by a Florida- registered structural engineer.

419.4.2.5.5 The glazed openings inside or outside of the protective systems shall meet the cyclical loading requirements specified by Sections 1626.2 through 1626.4.

419.4.2.5.6 All of the exterior impact protective systems shall be designed and installed so that they do not come in contact with the glazing under uniform, impact or cyclic pressure loading. The location or application of exterior impact protective systems shall not prevent required exit egress from the building.

419.4.2.5.7 When not being utilized to protect the windows, the protective systems shall not reduce the clear window opening below that required by this code for the patient room.

419.4.2.6 Heating, ventilation and air-conditioning (HVAC) standards.

419.4.2.6.1 Air-moving equipment, dx condensing units, through-wall units and other HVAC equipment located outside of or on the roof of the new facility or wing or floor addition to an existing facility and providing service to the new facility or wing or floor addition to an existing facility shall be permitted only when either of the following are met:

419.4.2.6.1.1 They are located inside a penthouse designed to meet the wind load requirements of the *Florida Building Code, Building*; or

419.4.2.6.1.2 Their fastening systems are designed to meet the wind load requirements of the *Florida Building Code, Building* and they and all associated equipment are protected as specified in Sections 1626.2 through 1626.4 from damage by horizontal impact by a separate and independent structure that allows access to all parts of the equipment at all times.

419.4.2.6.2 All occupied patient areas and patient support areas shall be supplied with sufficient HVAC as determined by the facility to ensure the health, safety and well-being of all patients and staff during and immediately following a disaster.

419.4.2.6.3 As determined by the facility these selected HVAC systems and their associated support equipment such as a control air compressor essential to the maintenance of the occupied patient and patient support area(s) shall receive their power from the emergency power supply system(s).

419.4.2.6.4 Ventilation air change rates in occupied patient areas shall be maintained as specified in this section during and immediately following a disaster.

419.4.2.6.5 Auxiliary equipment and specialties such as hydronic supply piping and pneumatic control piping shall be located, routed and protected in such a manner as determined by the facility to ensure the equipment receiving the services will not be interrupted.

419.4.2.7 Plumbing standards.

419.4.2.7.1 There shall be an independent on-site supply (i.e., water well) or on-site storage capability (i.e., empty water storage containers or bladders) of potable water at a minimum quantity of 3 gallons (14 L) per in-patient in the new facility or wing or floor addition to an existing facility per day during and immediately following a disaster. For planning purposes the number of in-patients shall be determined in writting by the facility. Hot water in boilers or tanks shall not be counted to meet this requirement.

419.4.2.7.2 There shall be an independent onsite supply or storage capability of potable water at a minimum quantity of 1 gallon (3.7 L) per facility staff, and other personnel in the new facility or wing or floor addition to an existing facility per day during and immediately following a disaster. For planning purposes, the number of these personnel shall be determined in writing by the facility. Hot water in boilers or tanks shall not be counted to meet this requirement.

419.4.2.7.3 The facility shall determine what amount of water will be sufficient to provide for patient services, and shall maintain an on-site supply or on-site storage of the determined amount.

419.4.2.7.4 When utilized to meet the minimum requirements of this rule, selected system appurtenances such as water pressure maintenance house pumps, and emergency water supply well pumps shall take power from the emergency power supply system(s).

419.4.2.8 Medical gas systems standards. The storage, distribution piping system and appurtenances serving the occupied patient area(s) and patient support area(s) shall be contained within a protected area(s) designed and constructed to meet the structural requirements of the code and debris impact requirements as specified by Sections 1626.2 through 1626.4.

419.4.2.9 Emergency electrical generator and essential electrical system standards.

419.4.2.9.1 There shall be an on-site Level 1 emergency electrical generator system designed to support the occupied patient area(s) and patient support area(s) with at least the following support services:

419.4.2.9.1.1 Ice-making equipment to produce ice for the patients served, or freezer storage equipment for the storage of ice for the patients served.

419.4.2.9.1.2 Refrigerator unit(s) and food service equipment if required by the emergency food plan.

419.4.2.9.1.3 At a minimum, there shall be one clothes washer and one clothes dryer for laundry service.

419.4.2.9.1.4 Selected HVAC systems as determined by the facility and other systems required by this code.

419.4.2.9.2 The emergency generator system shall be fueled by a fuel supply stored on-site sized to fuel the generator for 100 percent load for 64 hours or 72 hours for actual demand load of the occupied patient area(s) and patient support area(s) and patient support utilities during and immediately following a disaster, whichever is greater.

419.4.2.9.3 The fuel supply shall either be located below ground or contained within a protected area that is designed and constructed to meet the structural requirements of the code and debris impact requirements of Sections 1626.2 through 1626.4. If an underground system is utilized, it shall be designed so as to exclude the entrance of any foreign solids or liquids.

419.4.2.9.4 All fuel lines supporting the generator system(s) for the occupied patient area(s) and patient support area(s) shall be protected also with a method designed and constructed to meet the structural requirements of the code and debris impact requirements of Sections 1626.2 through 1626.4.

419.4.2.9.5 All panel boards, transfer switches, disconnect switches, enclosed circuit breakers or emergency system raceway systems required to support the occupied patient area(s), patient support area(s) or support utilities shall be contained within a protected area(s) designed and constructed to meet the structural requirements of the code and debris impact requirements of Sections 1626.2 through 1626.4, and shall not rely on systems or devices outside of this protected area(s) for their reliability or continuation of service.

419.4.2.9.6 The emergency generator(s) shall be air or self-contained liquid cooled and it and other essen-

tial electrical equipment shall be installed in a protected area(s) designed and constructed to meet the structural requirements of the code and debris impact requirements of Sections 1626.2 through 1626.4.

419.4.2.9.7 If the facility does not have a permanent onsite optional stand-by generator to operate the normal branch electrical system, there shall be a permanently installed predesigned electrical service entry for the normal branch electrical system that will allow a quick connection to a temporary electrical generator. This quick connection shall be installed inside of a permanent metal enclosure rated for this purpose and may be located on the exterior of the building.

419.4.2.10 Fire protection standards.

419.4.2.10.1 If the facility requires fire sprinklers as part of its fire protection, either of the following shall be met:

419.4.2.10.1.1 On-site water storage capacity to continue sprinkler coverage, in accordance with the requirements of NFPA 13, *Sprinkler Systems*, or a fire watch, conducted in accordance with the requirements of Chapter 59A-3.081(a), *Florida Administrative Code.*

419.4.2.10.2 If the facility provides a fire watch in lieu of water storage to continue sprinkler coverage, then one 4-A type fire extinguisher or equivalent shall be provided for every three or less 2-A fire extinguishers required by NFPA 10, *Portable Extinguishers*. These additional extinguishers shall be equally distributed throughout the area they are protecting.

419.4.2.11 External emergency communications standards. (Reference Chapter 59A-3.081 *Florida Administrative Code* for requirements.)

SECTION 420
NURSING HOMES

420.1 Scope. Nursing homes shall comply with all applicable requirements of the code and the following design and construction standards as described herein and shall have plans reviewed and construction surveyed by the state agency authorized to do so by Chapter 553.80 (1)(c), *Florida Statutes*.

NOTE: For project submission and fee requirements, codes and standards for existing facilities, and other administrative, licensure, and programmatic provisions for nursing homes, see Agency for Health Care Administration [AHCA] Chapter 59A-4, *Florida Administrative Code* (F.A.C.) and Chapter 400 Part II, *Florida Statutes*.

420.2 Codes and standards for the design and construction of nursing homes. Except as modified and required by Section 420 of this code, Chapter 59A-4 *Florida Administrative Code* or by Chapter 400 Part II, *Florida Statutes*, all new nursing homes and all additions, alterations or renovations to existing nursing homes shall also be in compliance with the following codes and standards on the effective date of this code:

420.2.1 The fire codes described in Chapter 69A-53, *Uniform Fire Safety Standards for Hospitals and Nursing Homes, Florida Administrative Code.*

420.2.2 *The Guidelines for Design and Construction of Health Care Facilities* (the Guidelines), Part I, incorporated by reference.

420.2.3 *Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, Sheet Metal and Air Conditioning Contractors National Association, Inc.* (SMACNA).

420.3 Additional physical plant requirements for nursing homes. In addition to the codes and standards referenced in Section 420.2 of this code, the following minimum standards of construction and specified minimum essential facilities shall apply to all new nursing homes including those that admit children 0 years through 20 years of age and to all additions, alterations or renovations to an existing nursing home including one that admits children 0 years through 20 years of age on the effective date of this code:

420.3.1 Nursing unit. Each nursing unit shall consist of the resident rooms and support areas as required in Sections 420.3.2 and 420.3.3 and shall meet the following standards:

420.3.1.1 Each nursing unit shall be arranged to avoid unnecessary and unrelated travel through the unit.

420.3.1.2 Travel distance from the entrance to a nurses' station, and from a clean utility and a soiled utility room(s) or function(s) to the middle of the entrance door of the farthest resident room served shall be a maximum of 150 feet (45.72 m).

420.3.1.3 Clustered nursing units with resident rooms adjacent to decentralized resident support and service areas, and with the utilization of satellite staff work areas shall be permitted.

420.3.2 Resident rooms. Each resident room shall meet the following standards:

420.3.2.1 Maximum room capacity shall be two residents. Where renovation work is undertaken and the present capacity is more than two residents, maximum room capacity shall be no more than the existing capacity with a maximum capacity of four residents. Nursing homes that admit children 0 through 20 years of age may have a maximum room capacity of four residents in those rooms.

420.3.2.2 Rooms shall have a minimum of 100 square feet (9.29 m^2) of clear floor area per bed in multiple-bed rooms and 120 square feet (11.15 m^2) of clear floor area in single-bed rooms, exclusive of the space consumed by toilet rooms, closets, lockers, wardrobes, lavatories, alcoves, and door swings into the room or entrance vestibules, whichever is greater. For the purpose of minimum clear floor area, the entrance vestibule is defined as that floor area located between the room entrance door and the room floor area containing the resident bed(s). The dimensions and arrangement of rooms shall be such that there shall be a minimum of 3 feet (0.91 m) between the sides and foot of the bed and any wall or any other fixed obstruction or adjacent bed. For planning purposes, a full-size bed is assumed to be 3 feet 6 inches (1.07 m)

wide by 8 feet (2.43 m) long. In multiple-bed rooms, a clearance of 3 feet 8 inches (1.11 m) to any fixed obstruction shall be available at the foot of each bed to permit the passage of equipment and beds. Where renovation work is undertaken, every effort shall be made to meet these minimum space standards. When this is not possible due to existing physical constraints, with the approval of the agency, resident rooms shall have no less than 80 square feet (7.43 m^2) of clear floor area per bed in multiple-bed rooms and 100 square feet (9.29 m^2) of clear floor area in single-bed rooms exclusive of the space consumed by toilet rooms, closets, lockers, wardrobes, lavatories, alcoves, and door swings into the room or entrance vestibules, whichever is greater.

420.3.2.3 Each resident room shall have a bedside table, a reading lamp, a well-constructed appropriate bed, and a nonfolding type armchair for each resident. There shall be an over-bed table available for a minimum of 50 percent of the licensed beds in the facility.

420.3.2.4 Each resident room shall be provided with a window(s) that shall have a minimum 20 feet (6.10 m) unobstructed vista measured perpendicularly from the plane of the window. Beds shall be located no more than two deep from windows in renovated construction.

420.3.2.5 A hand-washing facility complete with mixing faucet shall be provided in each resident toilet room and in each resident room without an exclusive toilet room, and in renovated facilities with rooms containing more than two beds.

420.3.2.6 Each resident shall have access to a toilet room without having to enter the general corridor area. One toilet room shall serve no more than four beds and no more than two resident rooms. The door shall be side hinged, swing out from the toilet room, and unless otherwise required by this code, be at least 32 inches (813 mm) wide. The toilet room door that swings open into the resident room shall not impede the swing of any other door that opens into the resident room.

420.3.2.7 Each resident room shall have a wardrobe, locker or closet for each resident. Each wardrobe, locker or closet shall have minimum inside dimensions of 1 foot 10 inches (0.55 m) in depth by 1 foot 8 inches (0.51 m) in width. Each shall be accessible to the resident at all times and shall have a shelf and clothes rod that permits a vertically clear hanging space for full-length garments. When the wardrobe, locker or closet is designed to meet the requirements for accessibility per Chapter 11 of this code, it shall include additional accessible storage area(s) for full-length garments. The shelf may be omitted if the clothing unit provides at least two drawers.

420.3.2.8 In multiple-bed rooms, visual privacy shall be provided for each resident by the installation of flame-retardant cubicle curtains or equivalent built-in devices. The design for privacy shall not restrict resident access to the entrance, resident armchair, hand washing facility, toilet, wardrobe, locker or closet.

420.3.3 Service areas. The size and features of each service area will depend upon the number and type of residents served. Service areas may be arranged and located to serve more than one nursing unit, but at least one such service area shall be provided on each nursing floor. The following service areas shall be located in or be readily accessible to each nursing unit:

420.3.3.1 A centralized staff work area shall be provided. It shall have space for supervisory administrative work activities, charting, and storage. The minimum area required shall be equal to 2 square feet (0.19 m^2) for each resident bed served. If a decentralized nursing unit model is utilized, the functions of administrative work, charting and storage may be located among several separate direct care staff work areas. In this case, a centralized staff work area is still required but shall not be required to provide space for these activities and may be reduced in size in accordance with the functional program.

420.3.3.2 A staff toilet room with hand-washing facilities shall be provided conveniently located to each nursing unit.

420.3.3.3 Lockable closets, drawers or compartments shall be provided on the unit for safekeeping of staff personal effects.

420.3.3.4 Staff lounge area(s) shall be provided and may be shared by more than one nursing unit if the lounge is centrally located.

420.3.3.5 A clean utility or clean holding room for storage and distribution of clean supply materials shall be provided. If the room is used for preparing resident care items, it shall contain a work counter, a hand-washing facility, and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as a part of a system for distribution of clean and sterile supply materials, the work counter and hand-washing facility requirements may be omitted. The minimum size of the room shall be 60 square feet (5.57 m^2).

420.3.3.6 Soiled utility or soiled holding room(s) shall be provided. The soiled utility function shall be comprised of a flushing rim clinical service sink with bedpan rinsing device, a double compartment sink, soiled linen receptacles, waste receptacles and a work counter with a usable minimum work surface area of 6 square feet (0.56 m^2). The total minimum size of the function shall be 80 square feet (7.43 m^2) and may be allocated among several soiled utility or soiled holding rooms. Rooms used only for the holding of soiled materials need contain only a hand washing facility. All rooms utilized for the holding of soiled materials shall meet the requirements for hazardous areas as required by NFPA 101, *Life Safety Code* as adopted by the *Florida Fire Prevention Code*.

420.3.3.7 If required by the functional program as defined by The Guidelines, a minimum of one sanitizer shall be provided per facility. The sanitizer may be of the hot water or chemical type.

420.3.3.8 A medicine preparation room or a self-contained medicine dispensing unit shall be provided for the

provision of medication distribution and shall be under the visual control of the staff. If a medicine preparation room is utilized, it shall be equipped with a lockable door, have a minimum area of 50 square feet (4.65 m^2) and shall contain a refrigerator, locked storage for controlled drugs, a hand washing facility, and a work counter with a minimum of 6 square feet (0.56 m^2) of work surface. If a self-contained medicine dispensing unit is utilized, it may be located at the nurses' station, in the clean utility room, in an alcove, or in other spaces convenient for staff control provided the area occupied by the unit does not encroach upon required minimum areas. The dispensing unit may be used in a medicine preparation room as locked storage for controlled drugs within the minimum area of 50 square feet (4.65 m^2), however, the standard "cup sinks" provided in many self-contained units shall not be a substitute for the required hand-washing facility. If there is no linen storage in the clean utility room, medicine preparation may be part of the clean utility room in which case an additional 20 square feet (1.8 m^2) dedicated for this purpose shall be required. A refrigerator shall also be required if medicine preparation is included in this room.

420.3.3.9 An equipment storage room(s) shall be provided for storage of nursing unit equipment. The minimum area required shall be equal to 2 square feet (.19 m^2) for each resident bed served, with no room being less than 30 square feet (2.79 m^2) in area.

420.3.3.10 A housekeeping room(s) shall be provided for storage and use of housekeeping supplies and equipment. Each room shall have a service sink. The minimum area required in each room shall be 20 square feet (1.86 m^2).

420.3.3.11 A clean linen storage room, closet or area shall be provided. This area may be located within the clean utility or clean holding room. It shall be large enough to accommodate the storage of linen carts. If in compliance with the *Florida Fire Prevention Code* a closed-cart system may be used and stored in an alcove open to the corridor.

420.3.3.12 A nourishment room for serving nourishments between meals shall be provided that shall contain a work counter, refrigerator, storage cabinets, and sink. Ice for residents' consumption shall be provided by an icemaker unit that may serve more than one nourishment station if the nourishment stations are in close proximity to each other. Where the icemaker unit is accessible to residents or the public, it shall be a self-dispensing type. The nourishment room shall include space for trays and dishes used for nonscheduled meal service. Hand-washing facilities shall be in or immediately accessible from the nourishment room.

420.3.3.13 Storage alcove space for a minimum of one wheelchair and one stretcher shall be provided in an area located away from normal traffic.

420.3.3.14 Resident bathing facilities shall be provided with a minimum of one bathtub, hydrotub, or shower for every 20 beds or fraction thereof not otherwise served by bathing facilities in resident rooms. Residents shall have access to at least one bathing room per floor or unit sized to permit assisted bathing in a tub or shower. The bathtub in this room shall be accessible to residents in wheelchairs and the shower shall accommodate a shower gurney with fittings for a resident in a recumbent position. Other tubs or showers shall be in individual rooms or curtained enclosures with space for private use of the bathing fixture, for drying and dressing and access to a grooming location containing a sink, mirror and counter or shelf. A separate private toilet shall be provided that is directly accessible to each multibathing fixture central bathing area without requiring entry into the general corridor. This toilet may also serve as a toilet training facility.

420.3.4 Resident support areas.

420.3.4.1 Dining, lounges and recreation areas for residents shall be provided. The total area of these spaces shall be a minimum of 35 square feet (3.25 m^2) per bed with a minimum total area of 225 square feet (20.90 m^2). At least 20 square feet (1.86 m^2) per bed shall be available for dining. Additional space may be required for resident day care programs.

420.3.4.2 Storage for supplies, resident needs, and recreation shall be provided. This area shall be on site but not necessarily in the same building as the resident rooms, provided access is convenient. The minimum required area shall be 5 square feet (0.46 m^2) per bed up to 600 square feet (55.74 m^2).

420.3.4.3 Physical, speech, and occupational therapy units shall provide the following.

420.3.4.3.1 Space for files, records and administrative activities.

420.3.4.3.2 Provisions for wheelchair residents.

420.3.4.3.3 Storage for supplies and equipment.

420.3.4.3.4 Hand-washing facilities within the therapy unit.

420.3.4.3.5 Space and equipment for carrying out each of the types of therapy that the facility will provide.

420.3.4.3.6 Provisions for resident privacy.

420.3.4.3.7 Housekeeping rooms, in or near the unit.

420.3.4.3.8 Resident toilet room(s) usable by wheelchair residents.

420.3.4.4 A barber/beauty room shall be provided with facilities and equipment for resident hair care and grooming. The area of the room shall be a minimum of 200 square feet (18.58 m^2) with the least dimension of 12 feet (3.66 m).

420.3.5 Dietary facilities.

420.3.5.1 Dietary facilities shall be provided for residents and others as may be appropriate. No part of the kitchen area may be used as a pass through to the linen/laundry area. The dietary area shall contain the fol-

lowing facilities, in the size and number appropriate for the type of food service selected:

420.3.5.1.1 Storage space, including cold storage, for at least a seven-day supply of food shall be provided.

420.3.5.1.2 Food preparation facilities for cook to serve, cook to chill or a proprietary system of food preparation and adequate space and equipment for production shall be provided.

420.3.5.1.3 Employee dining and serving lines shall not be permitted in the dietary facilities area.

420.3.5.1.4 Hand-washing facilities shall be conveniently located in the food preparation area.

420.3.5.1.5 Facilities for assembly and distribution of resident meals shall be provided.

420.3.5.1.6 Ware washing space shall be located in a room or an alcove separate from the food preparation and serving area. Commercial-type ware washing equipment shall be provided. Space shall also be provided for receiving, scraping, sorting, and stacking soiled tableware and for transferring clean tableware to the use areas. Convenient hand washing facilities shall be available on the soiled dish side of the ware washing area.

420.3.5.1.7 Pot washing facilities shall be provided.

420.3.5.1.8 Storage areas and cleaning facilities for cans, carts, and mobile-tray conveyors shall be provided.

420.3.5.1.9 An office for the food service manager shall be provided.

420.3.5.1.10 A toilet, hand-washing facility and lockers for dietary staff shall be located within the dietary facilities area. A vestibule shall be provided between the toilet and the kitchen.

420.3.5.1.11 A housekeeping room located within the dietary facilities area shall be provided and shall include a service sink and storage space for housekeeping equipment and supplies.

420.3.5.1.12 An icemaker unit shall be provided and may be located in the food preparation area or in a separate room.

420.3.6 Administrative and public areas shall include the following:

420.3.6.1 A covered vehicular drop-off and pedestrian entrance that is located at grade level and that provides shelter from inclement weather shall be provided.

420.3.6.2 An administrative/lobby area shall be provided that shall include a counter or desk for reception and information, a public waiting area, public toilet facilities, public telephone and an electric drinking fountain.

420.3.6.3 General offices shall be provided for business transactions, admissions, social services, private interviews, medical and financial records, and administrative and professional staff. Clerical files and staff office space shall be provided as needed. At a minimum there shall be a private office for the administrator and director of nursing.

420.3.6.4 A multipurpose room(s) shall be provided for conferences, meetings, and health education purposes, and shall include provisions for the use of visual aids. One multipurpose room may be shared by several services. The minimum area for this room shall be 120 square feet (11.15 m^2).

420.3.6.5 Storage for office equipment and supplies shall be provided.

420.3.7 Linen service.

420.3.7.1 Linen service shall be provided that shall have provisions for the storing and processing of clean and soiled linen for appropriate resident care. Processing may be done within the facility, in a separate building on or off site, or in a commercial or shared laundry. Where soiled linen is handled, at a minimum, the following elements shall be included:

420.3.7.1.1 A separate room for receiving and holding soiled linen until ready for pickup or processing shall be provided. Discharge from soiled linen chutes may be received within this room or in a separate room. A hand-washing facility and a utility sink shall be provided.

420.3.7.1.2 A central, clean linen storage and issuing room(s), in addition to the linen storage required at the nursing units shall be provided.

420.3.7.1.3 Parking of clean and soiled linen carts in separate areas from each other and out of traffic shall be provided.

420.3.7.1.4 Hand-washing facilities in each area where unbagged, soiled linen is handled shall be provided.

420.3.7.1.5 When linen is processed off site a service entrance protected from inclement weather for loading and unloading of linen shall be provided.

420.3.7.1.6 When linen is processed in a laundry facility located on site the following additional elements shall be provided:

420.3.7.1.6.1 A laundry processing room(s), separated by walls from other elements of the laundry, with commercial-type laundry equipment for washing and drying. Walls separating the functions of washing and drying are not required.

420.3.7.1.6.2 Storage for laundry supplies.

420.3.7.1.6.3 Arrangement of the laundry processes shall generally provide for an orderly work flow from dirty to clean to minimize cross traffic that might mix clean and soiled operations.

420.3.8 Housekeeping rooms/janitor's closets.

420.3.8.1 Housekeeping rooms or janitor's closets shall be provided throughout the facility as required to maintain a clean and sanitary environment but not less than one housekeeping room/janitor's closet shall be provided for each

floor. Each room shall contain a floor receptor or service sink and storage space for housekeeping equipment and supplies.

420.3.9 Engineering service and equipment areas.

420.3.9.1 Room(s) or separate building(s) for boilers, mechanical and electrical equipment shall be provided as required.

420.3.9.2 Room(s) for the storage of building maintenance supplies and solvents, facility drawings, records and manuals shall be provided as required.

420.3.9.3 A general maintenance area for repair and maintenance shall be provided as required.

420.3.9.4 Yard equipment and supply storage room, if provided, shall be located so that equipment may be moved directly to the exterior.

420.3.10 Details and finishes.

420.3.10.1 Potential hazards such as sharp corners, loose laid rugs or carpets, shall not be permitted.

420.3.10.2 Doors to all rooms containing bathtubs, showers, and water closets for resident use shall be equipped with privacy hardware that permits emergency access without keys. When such rooms have only one entrance or are small, the doors shall open outward and, if on the corridor, shall open into an alcove.

420.3.10.3 All interior doors, except those that automatically close upon smoke detection, shall be side hinged swinging type. Interior corridor doors, except those to small closets not subject to occupancy, shall not swing into the corridor.

420.3.10.4 Operable windows shall be equipped with insect screens.

420.3.10.5 Thresholds and expansion joint covers shall be designed to facilitate use of wheelchairs and carts and to prevent tripping and shall provide a smooth and level transition from surface-to-surface.

420.3.10.6 Grab bars, 1½ inches (38 mm) in diam, shall be installed in all resident showers, tubs, and baths and on both sides of all resident use toilets. Wall-mounted grab bars shall provide a 1½ inch (38 mm) clearance from walls and shall sustain a concentrated load of 250 pounds (113.4 kg).

420.3.10.7 Handrails with a maximum diameter of 1½ inches (38 mm) shall be provided on both sides of all corridors normally used by residents. Mounting height shall be between 36 inches (914 mm) and 42 inches (1067 mm). A clearance of 1½ inches (38 mm) shall be provided between the handrail and the wall. Rail ends shall return to the wall.

420.3.10.8 Each resident hand-washing facility shall have a mirror unless prohibited by the nursing program. Mirror placement shall allow for convenient use by both wheelchair occupants and ambulatory persons. Tops and bottoms may be at levels usable by individuals either sitting or standing. Additional mirrors may be provided for wheelchair occupants, or one separate full-length mirror located in the resident room may be provided to meet the needs of wheelchair occupants.

420.3.10.9 Provisions for soap dispensing and hand drying shall be included at all hand washing facilities. Those in resident use areas shall be paper or cloth towels enclosed to protect against dust or soil and shall be single-unit dispensing.

420.3.10.10 The minimum ceiling height throughout the facility shall be 8 feet (2.44 m) above the finished floor with the following exceptions:

420.3.10.10.1 Steam boiler and hot water generator rooms shall have ceiling clearances of at least 2 feet 6 inches (0.76 m) above the main header and connecting pipe.

420.3.10.10.2 Ceilings in corridors, storage rooms, resident room entrance vestibules and toilet rooms shall be at least 7 feet 6 inches (2.33 m).

420.3.10.10.3 Ceilings in normally unoccupied spaces and alcoves may be reduced to 7 feet (2.13 m).

420.3.10.10.4 Ceilings in exit passageways shall be a minimum of 8 feet (2.44 m) above the finished floor.

420.3.10.11 Only recessed soap dishes shall be allowed in patient use tubs and showers.

420.3.10.12 Towel bars shall be provided at each bathing facility.

420.3.10.13 A minimum of one electric drinking fountain shall be provided per resident floor.

420.3.10.14 Floor material shall be readily cleanable and appropriate for the location. If composition floor tiles are used, the interstices shall be tight. In residential care and sleeping areas, a base shall be provided at the floor line. Floors in areas used for food preparation and assembly shall be water resistant. Floor surfaces, including tile joints, shall be resistant to food acids. In all areas subject to frequent wet-cleaning methods, floor materials shall not be physically affected by germicidal cleaning solutions. Floors subject to traffic while wet, such as shower and bath areas, kitchens, and similar work areas, shall have a slip resistant surface and floor-to-base intersections shall be watertight. Carpet and padding in resident areas shall be stretched tight, in good repair and free of loose edges or wrinkles that might create hazards or interfere with the operation of wheelchairs, walkers or wheeled carts.

420.3.10.15 Wall finishes shall be washable and, if near plumbing fixtures, shall be smooth and have a moisture-resistant finish. Finish, trim, walls, and floor constructions in dietary and food storage areas shall be free from rodent and insect harboring spaces.

420.3.10.16 Basic wall construction in areas not subject to conditioned air shall be constructed of masonry, cement plaster or moisture-resistant gypsum wallboard.

420.3.10.17 The finishes of all exposed ceilings and ceiling structures in the dietary facilities area shall be readily cleanable with routine housekeeping equipment.

420.3.10.18 Toilet compartment partitions and urinal screens shall not be constructed of enameled steel.

420.3.10.19 All smoke partitions, horizontal exits and exit passageway partitions shall be constructed prior to the construction of intervening walls.

420.3.10.20 Smoke partitions shall be constructed so as to provide a continuous smoke-tight membrane from exterior wall to exterior wall and from the floor to the underside of the deck above. This includes interstitial space and the area above solid fire-tested membranes.

420.3.10.21 Where it is not possible to inspect fire/smoke partitions because of the fire-tested membrane, fire-rated access panels shall be installed adjacent to each side of the smoke partitions at intervals not exceeding 30 feet (9.00 m) and in such locations as necessary to view all surfaces of the partition. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings shall be effectively and permanently identified with signs or stenciling. Such identification shall be above any decorative ceiling and in concealed spaces. Suggested wording for a fire/smoke partition is as follows: "FIRE AND SMOKE BARRIER – PROTECT ALL OPENINGS."

420.3.10.22 Where electrical conduits, cable trays, ducts and utility pipes pass through the smoke partition, the utilities shall be located so that access is maintained to adjacent wall surfaces and to all damper access panels. The details shall show the studs and reinforcing half studs so that proper support is provided for the wall surfacing material. There shall be a minimum clearance of 6 inches (152 mm) between all conduits, piping, and duct work at corridor walls to facilitate the inspection of these walls.

420.3.11 Elevators. (Where required).

420.3.11.1 All buildings having resident use areas on more than one floor shall have hospital-type electric or hydraulic elevator(s) that shall be in compliance with the requirements of Chapter 30 of this code and Chapter 69A-47, *Florida Administrative Code*, "Uniform Fire Safety Standards for Elevators."

420.3.11.2 In the absence of an engineered traffic study, the minimum number of elevators shall be as follows:

420.3.11.2.1 At least one elevator shall be installed where resident beds are located on any floor other than the main entrance floor.

420.3.11.2.2 When 60 to 200 resident beds are located on floors other than the main entrance floor, at least two elevators, one of which shall be of the hospital-type and capacity, shall be installed.

420.3.11.2.3 When 201 to 350 resident beds are located on floors other than main entrance floor, at least three elevators, two of which shall be of the hospital-type and capacity, shall be installed.

420.3.11.2.4 For facilities with more than 350 resident beds above the main entrance floor, the number of elevators shall be determined from a facility plan study and from the estimated vertical transportation requirements.

420.3.11.2.5 When the skilled nursing unit is part of a general hospital, elevators may be shared.

420.3.11.3 Cars of elevators shall have inside dimensions that accommodate a resident bed with attendants. Cars shall be at least 5 feet (1.52 m) wide by 7 feet 6 inches (2.29 m) deep. The car door shall have a clear opening of not less than 4 feet (1.22 m).

420.3.11.4 Elevator call buttons shall not be activated by heat or smoke. If employed, light beam door activators shall be used in combination with door-edge safety devices and shall be connected to a system of smoke detectors such that the light control feature will disengage or be overridden if it encounters smoke at any landing.

420.3.12 Water supply and sewage disposal.

420.3.12.1 An approved, accessible, adequate, safe and potable supply of water shall be provided. The water supply shall be accessible and available at all times for drinking, fire protection, culinary, bathing, cleaning and laundry purposes.

420.3.12.2 Hot water shall be supplied to all lavatory and sink plumbing fixtures available for use by residents and staff.

420.3.12.3 An approved, adequate and safe method of sewage collection, treatment and disposal shall be provided for each nursing home.

420.3.13 Ventilating and air-conditioning systems.

420.3.13.1 Mechanical equipment shall be defined as equipment utilized in air-conditioning, heating, ventilating systems and associated electrical, electronic and pneumatic components required for the mechanical equipment to provide the function intended by the application of the equipment. New and existing equipment replacements shall comply with these requirements.

420.3.13.2 Mechanical equipment shall be installed in a designated equipment room(s), or in a space(s) located in an attic(s).

420.3.13.3 If the unit serves only one room it may be located above the ceiling and shall be accessible through an access opening in accordance with this code. Access panels are not required for lay-in ceiling installations, provided the service functions are not obstructed by other above-ceiling construction, such as electrical conduits, piping, audio visual cabling and like equipment components or supports.

420.3.13.4 Ventilation shall be provided by mechanical means in all rooms in new facilities and in all renovated or remodeled rooms. The minimum air quantities and filtration efficiencies shall be met as set forth in Table 420.3.13.7 for those spaces that are listed.

420.3.13.5 For spaces listed in the minimum ventilated rate table, central station type air-handling equipment

shall be used. Package terminal air-conditioning units or fan coils may be used to serve resident rooms and shall be provided with 20-percent filters minimum.

420.3.13.6 System designs utilizing fan coil or package terminal air-conditioning units shall have the outdoor air ventilation damper permanently closed. The ventilation requirement shall be satisfied by a central station type air handling unit provided with a 30-percent filter minimum or as required by the listed space served. Spaces designated for the exclusive use of physical plant personnel need not comply with this requirement.

420.3.13.7 Administrative and other staff-only areas shall be provided with outside air at the minimum rate of 20 cfm (9.43 L/s) per person, and the central system shall have a minimum of 30 percent ASHRAE dust spot efficiency filter.

420.3.13.8 All outdoor air intakes shall be located a minimum of 3 feet (0.91 m) above surrounding surfaces and a minimum of 10 feet (3.05 m) horizontally from any exhaust air or plumbing vent.

420.3.13.9 All filters in systems in excess of 1000 cfm (28.32 m^3/min) capacity shall be installed with differential pressure gauges. The filter gauge shall have the range of acceptable filter operation clearly and permanently indicated.

420.3.13.10 Filter housings for 80-percent efficiency filters shall be fully gasketed and sealed with mechanical latching devices capable of exerting and maintaining a continuous, uniform sealing pressure on the filter media when in the latched, closed position.

420.3.13.11 The transfer of air quantities through one space to an adjacent space is not permitted except that the transfer of air to maintain space relative pressure by the under cutting of doors is permitted. The maximum allowable air quantity for door undercuts shall be 75 cfm (35.38 L/s) for single door widths up to 44 inches (1117 mm).

420.3.13.12 Space relative pressure requirements shall be maintained throughout the entire system control range where variable volume systems are utilized.

420.3.13.13 Spaces having exhaust hoods shall have sufficient make-up supply air such that the required pressure relationship will not be affected by the operation of the hood.

420.3.13.14 All supply, return and exhaust ventilation fans shall operate continuously. Dietary hood, laundry area, administrative areas that are separated from all resident areas and support areas and maintenance area supply and exhaust fans shall be exempted from continuous *operation.*

420.3.13.15 Cooling coil condensate shall be piped to a roof drain, floor drain or other approved location.

420.3.14 Exhaust.

420.3.14.1 Exhaust fans and other fans operating in conjunction with a negative duct system pressure shall be located at the discharge end of the system. Fans located immediately within the building located at the end of all exhaust ducts shall be permitted. Existing, nonconforming systems need not be brought into compliance when equipment is replaced due to equipment failure.

420.3.14.2 Exhaust hoods in food preparation areas shall be listed or certified by a nationally recognized testing laboratory (NRTL).

420.3.15 Ducts.

420.3.15.1 All new facility construction shall have totally ducted supply, return, exhaust and outside air systems including areas of all occupancy classifications.

420.3.15.2 In new construction, duct system risers penetrating more than one floor shall be installed in vertical fire-rated shafts. Horizontal offsets of the risers shall not be allowed. Fire/smoke dampers shall be installed at duct penetrations of the chase. Existing nonconforming systems shall be brought into compliance when remodel or renovation work is proposed.

420.3.16 Fan and damper control during fire alarm.

420.3.16.1 During a fire alarm, fan systems and fan equipment serving more than one room shall be stopped to prevent the movement of smoke by mechanical means from the zone in alarm to adjacent smoke zones.

420.3.16.2 Air-handling and fan coil units serving exit access corridors for the zone in alarm shall shut down upon fire alarm.

420.3.16.3 Smoke or fire/smoke dampers shall close upon fire alarm and upon manual shutdown of the associated supply, return or exhaust fan.

420.3.17 Plumbing.

420.3.17.1 All plumbing fixtures provided in spaces shall conform to the requirements of Table 420.3.17.2 of plumbing fixtures and minimum trim.

420.3.17.2 The temperature of hot water supplied to resident and staff use lavatories, showers and bath shall be between 105°F (41°C) and 115°F (46°C) at the discharge end of the fixture.

420.3.17.3 Wall-mounted water closets, lavatories, drinking fountains and hand-washing facilities shall be attached to floor-mounted carriers and shall withstand an applied vertical load of a minimum of 250 pounds (113.39 kg) to the front of the fixture.

420.3.17.4 Grease interceptors shall be located outside of the building.

420.3.17.5 Provide deep seal traps for floor drains in resident showers.

420.3.17.6 Food preparation sinks, pot washing, dishwashers, janitor sinks, floor drains, and cart and can wash drains shall run through the grease trap. Garbage disposers shall not run through the grease trap.

TABLE 420.3.13.7
NURSING HOME MINIMUM VENTILATION RATE[8]

ROOM NAME OR AREA FUNCTION	SPACE RELATIVE PRESSURE[1]	TOTAL AIR QUANTITIES[2]	OUTDOOR AIR QUANTITIES[2]	EXHAUST 100 PERCENT	FILTRATION EFFICIENCY PERCENT [3,4]
Barber and Beauty	–	10	2.00	Yes	30
Clean Linen, Utility or Holding	OUT	4	2.00	No	30
Dining	–	4	2.00	No	30
Dishwashing	IN	10	–	Yes	30
Exam/Treatment	–	6	2.00	No	80
Food Prep/Kitchen[5]	–	20	7.00	No	30
Hydro or Physical Therapy	IN	4	2.00	No	30
Housekeeping/ Janitor's Closet	IN	10	–	Yes	30
Laundry/Drying (clean)	OUT	10	3.00	No	30
Laundry/Holding (dirty)	IN	10	–	Yes	30
Laundry/Wash	–	10	3.00	Yes	30
Maintenance[6]	IN	10	2.00	Yes	30
Medicine Preparation Room	OUT	4	2.00	No	80
Nourishment Station	–	4	2.00	No	30
Oxygen Storage[7]	IN	8	–	Yes	30
Recreation	–	4	2.00	No	30
Resident Corridor	–	2	1.00	No	30
Resident Room[4]	–	2	2.00	No	80
Soiled Linen, Utility or Holding	IN	10	–	Yes	30
Storage[6]	–	2	–	No	30
Toilets and Baths	IN	10	–	Yes	30

Notes:

1. Design of the ventilation system shall provide air movement that is generally from clean to less clean areas. Air movement is in relationship to the adjacent room or area and is designated as OUT (positive), IN (negative) and - (neutral). If any form of variable-air-volume or load shedding system is used for energy conservation, it must not compromise the room pressure balancing relationships or the minimum air changes required by the table.
2. Tabular numerical values are space volume (cubic feet or cubic ms) per hour.
3. Filtration efficiency ratings are based on average dust spot efficiency per ASHRAE 52.
4. Filter values apply to central station type air handling units. Where package terminal or fan coil air conditioning units are utilized, filter efficiency value may be 20 percent minimum.
5. Includes kitchen hood air quantities.
6. Buildings or spaces housing these functions may utilize package terminal or fan coil air conditioning units.
7. Provide a dedicated, spark-resistant exhaust fan.
8. Rooms or areas where specific ventilation rates are not given in the table shall be ventilated in accordance with the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 62, *Ventilation for Acceptable Indoor Air Quality* and *ASHRAE Handbook-HVAC Applications*. OSHA standards and NIOSH criteria require special ventilation requirements for employee health and safety within nursing facilities. For multi-function room designations, the most stringent tabular requirement shall govern.

TABLE 420.3.17.2
PLUMBING FIXTURES AND MINIMUM TRIM

ROOM/FUNCTION	FIXTURE, FITTING, AND TRIM
Barber and Beauty	G-6
Bed Pan Sanitizer	K-7
Clean Utility Room	C-2
Corridor per nursing unit	I-5
Eye Wash Station(s)	L-5
Exam/Treatment Room	A-2
Housekeeping/Janitor's Closet	E-6
Laundry	A-1; H-1
Medication Preparation Room	C-2
Nourishment Room	C-2
Resident Baths	J-1
Resident bedrooms with three or more beds	A-1
Resident Room Bath	A-1; B-4; J-1
Resident Toilet Rooms	A-1; B-4
Soiled Utility Room(s)	D-2; F-3 AND 4; K-5
Therapy Areas	A-2
Toilet Rooms, public and staff	A-1; B-5

FIXTURE LEGEND	
A. Lavatory B. Water Closet C. Sink, Single Compartment D. Sink, Double Compartment E. Sink or Receptor, Janitor F. Sink, Clinical Service and Rinsing Device	G. Sink, Shampoo H. Sink, Laundry I. Electric Drinking Fountain J. Bathing Facilities or Shower (Note 1) K. Sanitizer w/ rinse water at 140°F (60°C) or chemical rinse. If required by the functional program in The Guidelines. L. Eye Wash Fixtures

FIXTURE LEGEND

1. Hot and cold supplies.
2. Hot and cold supplies with wrist blades from $3^1/_2$ inches (89 mm) to $4^1/_2$ inches (114 mm) in length or foot or knee control and a gooseneck spout with discharge a minimum of 5 inches (127 mm) above the fixture rim.
3. Hot and cold supplies with elbow blades a minimum of 6 inches (152 mm) long or foot or knee control.
4. Bedpan rinsing attachment, cold water only.
5. Cold supply.
6. Hot and cold supplies with hose connection and backflow preventer.
7. Hot water supply.

NOTES:

1. Mixing valves used in shower applications shall be of the balanced-pressure type design.
2. If eye wash stations are provided, they shall be installed in accordance with American National Standards Institute (ANSI) Z358.1 for Emergency Eyewash and Shower Equipment.

420.3.17.7 Ice machines, rinse sinks, dishwashers, and beverage dispenser drip receptacles shall be indirectly wasted.

420.3.17.8 Each water service main, branch main, riser and branch to a group of fixtures shall have valves. Stop valves shall be provided for each fixture. Panels for valve access shall be provided at all valves.

420.3.17.9 Backflow preventers (vacuum breakers) shall be installed on bedpan-rinsing attachments, hose bibs and supply nozzles used for connection of hoses or tubing in housekeeping sinks and similar applications.

420.3.17.10 A backflow preventer shall be installed on the facility main water source(s).

420.3.17.11 All piping, except control-line tubing, shall be identified. All valves shall be tagged, and a valve schedule shall be provided to the facility owner for permanent record and reference.

420.3.18. Medical gas and vacuum systems.

420.3.18.1 Provide a medical gas and vacuum system in conformance with the requirements for a Nursing Home as described in NFPA 99, *Health Care Facilities*.

420.3.18.2 Provide a dedicated area for the location of the oxygen system emergency supply source with an impervious, noncombustible, nonpetroleum-based surface located adjacent to the emergency low pressure gaseous oxygen inlet connection. Provision shall be made for securing the vessel to protect it from accidental damage.

420.3.19 Fire pump. (Where required).

420.3.19.1 Fire pumps and ancillary equipment shall be separated from other functions by construction having a 2-hour fire-resistance rating.

420.3.19.2 The fire pump normal service disconnect shall be rated to hold locked rotor current. If the approved normal service disconnect is located on the exterior, it shall be supervised by connection to the fire pump remote annunciator and shall provide a separate fire alarm system trouble indication.

420.3.19.3 When the fire pump is placed on the emergency system in addition to the normal supply, the emergency feeder protective device shall be sized in accordance with maximum rating or settings of Chapter 27 of the *Florida Building Code, Building*.

420.3.19.4 The fire pump transfer switch may be either manual or automatic. If located on the line side of the controller as a separate unit, the switch must be rated for the pump motor locked rotor current indefinitely and must be located in the pump room.

420.3.19.5 Combination fire pump controller and transfer switch units listed by the Underwriter's Laboratories, Inc., as prescribed by Chapter 27 of the *Florida Building Code, Building* are acceptable when the transfer switch has exposable and replaceable contacts, not circuit breaker types, rated for the available short-circuit current.

420.3.19.6 The fire pump shall be installed in a readily accessible location. When it is located on the grade level floor, there shall be direct access from the exterior.

420.3.20 Electrical requirements.

420.3.20.1 All material, including equipment, conductors, controls, and signaling devices, shall be installed to provide a complete electrical system with the necessary characteristics and capacity to supply the electrical facility requirements as shown in the specifications and as indicated on the plans. All materials and equipment shall be listed as complying with applicable standards of Underwriter's Laboratories, Inc., or other nationally recognized testing facilities. Field labeling of equipment and materials will be permitted only when provided by a nationally recognized testing laboratory (NRTL) that has been certified by the Occupational Safety and Health Administration (OSHA) for that referenced standard.

420.3.20.2 For purposes of this section, a resident room, a resident therapy area or an examination room shall be considered a "patient care area" as described in NFPA 99 *Health Care Facilities*, and Chapter 27, Electrical Systems, of this code.

420.3.20.3 Panels located in spaces subject to storage shall have the clear working space per Chapter 27, Electrical Systems, of this code, permanently marked "ELECTRICAL—NOT FOR STORAGE" with a line outlining the required clear working space on the floor and wall.

420.3.20.4 Panels and electrical equipment, other than branch circuit devices serving the corridor, shall not be located in egress corridors in new construction.

420.3.21 Lighting.

420.3.21.1 All spaces occupied by people, machinery and equipment within buildings, approaches to buildings and parking lots shall have electric lighting.

420.3.21.2 Resident bedrooms shall have general lighting and separate fixed night lighting. The night-light shall have a switch at the entrance to each resident's room. A reading light shall be provided for each resident. Resident reading lights and other fixed lights not switched at the door shall have switch controls convenient for use at the luminary. Wall-mounted switches for control of lighting in resident areas shall be of quiet operating type.

420.3.22 Receptacles.

420.3.22.1 Provide one general purpose duplex receptacle on another wall to serve each resident and one additional duplex receptacle at the head of the bed if a motorized bed is provided.

420.3.22.2 Duplex receptacles for general use shall be installed in all general purpose corridors, approximately 50 feet (15.24 m) apart and within 25 feet (7.62 m) of corridor ends.

420.3.23 Fire alarm systems.

420.3.23.1 A fire alarm annunciator panel shall be provided at a single designated 24-hour monitored location. The panel shall indicate audibly and visually, the zone of

actuation of the alarm and system trouble. As a minimum, devices located in each smoke compartment shall be interconnected as a separate fire alarm zone. Annunciator wiring shall be supervised. Annunciator shall clearly indicate the zone location of the alarm. Provide an adjacent zone location map to quickly locate alarm condition.

420.3.24 Nurse call systems.

420.3.24.1 A nurse call system shall be provided that will register a call from each resident bed to the related staff work area(s) by activating a visual signal at the resident room door and activating a visual and audible signal in the clean utility, soiled utility, nourishment station, medication prep and the master station of the nursing unit or subnursing unit. Audible signals may be temporarily silenced, provided subsequent calls automatically reactive the audible signal. In rooms containing two or more calling stations, indicating lights shall be provided for each calling station. In multicorridor nursing units, corridor zone lights shall be installed at corridor intersections in the vicinity of staff work areas.

420.3.24.2 An emergency calling station of the pull cord type shall be provided and shall be conveniently located for resident use at each resident toilet, bath or shower room but not inside of the shower. The call signal shall be the highest priority and shall be cancelled only at the emergency calling station. The emergency station shall activate distinctive audible and visual signals immediately.

420.3.24.3 The nurse call master station shall not block incoming resident calls. The master station control settings shall not prevent the activation of the incoming audible and visual signals.

420.3.24.4 In multiresident rooms, activation of an emergency call shall not cancel a normal call from the same room.

420.3.24.5 A corridor dome light shall be located directly outside of any resident care area that is equipped with a nurse call system.

420.3.25 Emergency electrical system.

420.3.25.1 A Type 1 essential electrical system shall be provided in all nursing homes as described in NFPA 99, *Health Care Facilities*. The emergency power for this system shall meet the requirements of a Level 1, Type 10, Class 48 generator as described in NFPA 110, *Emergency Standby Power Systems*.

420.3.25.2 In new construction, the normal main service equipment shall be separated from the emergency distribution equipment by locating it in a separate room. Transfer switches shall be considered emergency distribution equipment for this purpose.

420.3.25.3 Switches for critical branch lighting shall be completely separate from normal switching. The devices or cover plates shall be of a distinctive color. Critical branch switches may be adjacent to normal switches. Switches for life safety lighting are not permitted except as required for dusk-to-dawn automatic control of exterior lighting fixtures.

420.3.25.4 There shall be selected life safety lighting provided at a minimum of 1 footcandle (10 lux) and designed for automatic dusk-to-dawn operation along the travel paths from the exits to the public way or to safe areas located a minimum of 30 feet (9.14 m) from the building.

420.3.25.5 A minimum of one elevator per bank serving any patient use floor shall be connected to the equipment branch of the essential electric system and arranged for manual or automatic operation during loss of normal power. Elevator cab lighting, controls, and communication and signal systems shall be connected to the life safety branch.

420.3.25.6 If a day tank is provided, it shall be equipped with a dedicated low level fuel alarm and a manual pump. The alarm shall be located at the generator derangement panel.

420.3.25.7 Transfer switch contacts shall be of the open type and shall be accessible for inspection and replacement.

420.3.25.8 If required by the facility's emergency food plan, there shall be power connected to the equipment branch of the essential electrical system for kitchen refrigerators, freezers and range hood exhaust fans. Selected lighting within the kitchen and dry storage areas shall be connected to the critical branch of the essential electrical system.

420.3.26 Lightning protection.

420.3.26.1 A lightning protection system shall be provided for all new buildings and additions in accordance with NFPA 780, *Installation of Lightning Protection Systems.*

420.3.26.2 Where additions are constructed to existing buildings, the existing building's lightning protection system, if connected to the new lightning protection system, shall be inspected and brought into compliance with current standards.

420.3.26.3 There shall be surge protection for all normal and emergency electrical services.

420.3.26.4 Additional surge protection shall be provided for all low-voltage and power connections to all electronic equipment in critical care areas and life safety systems and equipment such as fire alarm, nurse call and other critical systems. Protection shall be in accordance with appropriate IEEE Standards for the type of equipment protected.

420.3.26.5 All low voltage system main or branch circuits entering or exiting the structure shall have surge suppressors installed for each pair of conductors and shall have visual indication for protector failure to the maximum extent feasible.

420.4 Physical plant requirements for disaster preparedness of new nursing home construction.

420.4.1 Definitions. The following definitions shall apply specifically to this section:

420.4.1.1 "**New facility**" means a nursing home which has not received a Stage II Preliminary Plan approval from the Agency for Health Care Administration pursuant to this section.

420.4.1.2 "Net square footage" means the clear floor space of an area excluding cabinetry and other fixed furniture or equipment.

420.4.1.3 "During and immediately following" means a period of 72 hours following the loss of normal support utilities to the facility.

420.4.1.4 "Occupied resident area(s)" means the location of residents inside of the new facility or in the addition of a wing or floor to an existing facility during and immediately following a disaster. If these residents are to be relocated into an area of the existing facility during and immediately following a disaster, then for these purposes, that location will be defined as the "occupied resident area."

420.4.1.5 "Resident support area(s)" means the area(s) required to ensure the health, safety and well-being of residents during and immediately following a disaster, such as a staff work area, clean and soiled utility areas, food preparation area and other areas as determined by the facility to be kept operational during and immediately following a disaster.

420.4.1.6 "On site" means either in, immediately adjacent to, or on the campus of the facility, or addition of a wing or floor to an existing facility.

420.4.1.7 "Resident(s) served" means the number of residents as determined by the facility that will be served in the occupied resident area(s) during and immediately following a disaster.

420.4.2 Disaster preparedness construction standards. The following construction standards are in addition to the physical plant requirements described in Sections 420.2 through 420.3. These minimum standards are intended to increase the ability of the facility to be structurally capable of serving as a shelter for residents, staff and the family of residents and staff and equipped to be self-supporting during and immediately following a disaster:

420.4.2.1 Space standards.

420.4.2.1.1 For planning purposes, each new facility shall provide a minimum of 30 net square feet (2.79 m^2) per resident served in the occupied resident area(s). The number of residents to be served is to be determined by the facility administration.

420.4.2.1.2 As determined by the facility, space for administrative and support activities shall be provided for use by facility staff to allow for care of residents in the occupied resident area(s).

420.4.2.1.3 As determined by the facility, space shall be provided for all staff and family members of residents and staff.

420.4.2.2 Site standards.

420.4.2.2.1 All new facilities and additions to existing facilities shall be located above the 100-year flood plain or hurricane Category 3 (Saffir-Simpson scale) hurricane surge inundation elevation, whichever requires the highest elevation, or

420.4.2.2.2 The floor elevation of all new occupied resident area(s) and all resident support area(s) and resident support utilities, including mechanical, electrical (except fuel storage as noted in Section 420.4.2.9.3 of this code) and food services shall be located above the 100-year flood plain or hurricane Category 3 (Saffir-Simpson scale) hurricane surge inundation elevations, whichever requires the highest elevation.

420.4.2.2.3 New additions or floors added to existing facilities, as determined by their site locations, shall meet either the requirements of Section 420.4.2.2.1 or 420.4.2.2.2 of this code, or be so designed and constructed as to be in compliance with the current standards of the National Flood Insurance Program of the Federal Emergency Management Agency, incorporated by reference and available from Federal Emergency Management Agency, Federal Insurance Administration, Attn. Publications, P.O. Box 70274, Washington, D.C. 20024.

420.4.2.2.4 Where an off-site public access route is available to the new facility at or above the 100-year flood plain, a minimum of one on-site emergency access route shall be provided that is located at the same elevation as the public access route.

420.4.2.2.5 New landscaping elements shall be located so if damaged they will not block the on-site emergency access route to the facility. Outdoor signs and their foundations shall be designed to meet the wind load criteria of this code.

420.4.2.2.6 New light standards and their foundations used for lighting the on-site emergency access route shall be designed to meet the wind load criteria of the American Society of Civil Engineers (ASCE 7), 50-year recurrence interval of wind velocity with appropriate exposure category dependent on site location.

420.4.2.3 Structural standards. Wind load design of the building structure and exterior envelope including exterior wall systems shall be designed in accordance with this code.

420.4.2.4 Roofing standards.

420.4.2.4.1 Roofing membrane material shall resist the uplift forces specified in this code. Roof coverings shall be installed according to the specifications provided by the manufacturer.

420.4.2.4.2 Loose-laid ballasted roofs shall not be permitted.

420.4.2.4.3 All new roof appendages such as ducts, tanks, ventilators, receivers, dx condensing units and decorative mansard roofs and their attachment systems shall be structurally engineered to meet the wind

load requirements of this code. All of these attachment systems shall be connected directly to the underlying roof structure or roof support structure.

420.4.2.5 Exterior unit standards.

420.4.2.5.1 All exterior window units, skylights, exterior louvers and exterior door units including vision panels and their anchoring systems shall be designed to resist the wind load requirements of this code and the debris impact requirements as specified by Sections 1626.2 through 1626.4.

420.4.2.5.2 Permanently attached protective systems such as shutters and baffling shall be designed to meet the wind load requirements of this code and the debris impact requirements as specified by Sections 1626.2 through 1626.4.

420.4.2.5.3 Removable protective systems designed to intricately fit with the wall/window system of the facility and stored on site at the facility and that meet the wind load requirements of this code and the debris impact requirements specified by Sections 1626.2 through 1626.4 may be used to protect the exterior units.

420.4.2.5.4 All anchoring and attachment to the building of both the permanently attached and removable protective systems shall be designed to meet wind load requirements of this code and the impact requirements specified by Sections 1626.2 through 1626.4. These designs shall be signed, sealed and dated by a Florida-registered structural engineer.

420.4.2.5.5 The glazed openings inside or outside of the protective systems shall meet the cyclical loading requirements specified by Sections 1626.2 through 1626.4.

420.4.2.5.6 All of the exterior impact protective systems shall be designed and installed so that they do not come in contact with the glazing under uniform, impact or cyclic pressure loading. The location or application of exterior impact protective systems shall not prevent required exit egress from the building.

420.4.2.5.7 When not being used to protect the windows, the protective systems shall not reduce the clear window opening below that required by this code for the resident room.

420.4.2.6 Heating, ventilation and air conditioning (HVAC) standards.

420.4.2.6.1 Air-moving equipment, dx condensing units, through-wall units and other HVAC equipment located outside of or on the roof of the facility shall be permitted only when either of the following are met:

420.4.2.6.1.1 They are located inside a penthouse designed to meet the wind load requirements of this code, or

420.4.2.6.1.2 Their fastening systems are designed to meet the wind load requirements of this code and they and all associated equipment are protected as specified in Sections 1626.2 through 1626.4 from damage by horizontal impact by a separate and independent structure that allows access to all parts of the equipment at all times.

420.4.2.6.2 All occupied resident areas and resident support areas shall be supplied with sufficient HVAC as determined by the facility to ensure the health, safety and well being of all residents and staff during and immediately following a disaster.

420.4.2.6.3 As determined by the facility, these selected HVAC systems and their associated support equipment, such as a control air compressor, essential to the maintenance of the occupied resident and resident support area(s) shall receive their power from the emergency power supply system(s).

420.4.2.6.4 Ventilation air change rates in occupied resident areas shall be maintained as specified in this section, during and immediately following a disaster.

420.4.2.6.5 Auxiliary equipment and specialties such as hydronic supply piping and pneumatic control piping shall be located, routed and protected in such a manner as determined by the facility to ensure the equipment receiving the services will not be interrupted.

420.4.2.7 Plumbing standards.

420.4.2.7.1 There shall be an independent on-site supply (i.e., water well) or on-site storage capability (i.e., empty water storage containers or bladders) of potable water at a minimum quantity of 3 gallons (11 L) per resident served per day during and immediately following a disaster. For planning purposes the number of in-patients shall be determined in writing by the facility. Hot water in boilers or tanks shall not be counted to meet this requirement.

420.4.2.7.2 There shall be an independent on-site supply or storage capability of potable water at a minimum quantity of 1 gallon (4 L) per facility staff, and other personnel in the facility per day during and immediately following a disaster. For planning purposes, the number of these personnel shall be estimated by the facility. Hot water in boilers or tanks shall not be counted to meet this requirement.

420.4.2.7.3 The facility shall determine what amount of water will be sufficient to provide for resident services, and shall maintain an on-site supply or on-site storage of the determined amount.

420.4.2.7.4 When used to meet the minimum requirements of this rule, selected system appurtenances such as water pressure maintenance house pumps and emergency water supply well pumps shall take power from the emergency power supply system(s).

420.4.2.8 Medical gas systems standards. The storage, distribution piping system and appurtenances shall be contained within a protected area(s) designed and constructed to meet the structural requirements of this code and debris impact requirements as specified by Sections 1626.2 through 1626.4.

420.4.2.9 Emergency electrical generator and essential electrical system standards.

420.4.2.9.1 There shall be an on-site Level 1 emergency electrical generator system designed to support the occupied resident area(s) and resident support area(s) with at least the following support services:

420.4.2.9.1.1 Ice-making equipment to produce ice for the residents served, or freezer storage equipment for the storage of ice for the residents served.

420.4.2.9.1.2 Refrigerator unit(s) and food service equipment if required by the emergency food plan;

420.4.2.9.1.3 At a minimum, there shall be one clothes washer and one clothes dryer for laundry service.

420.4.2.9.1.4 Selected HVAC systems as determined by the facility and other systems required by this code.

420.4.2.9.2 The emergency generator system shall be fueled by a fuel supply stored on-site sized to fuel the generator for 100 percent load for 64 hours or 72 hours for actual demand load of the occupied resident area(s) and resident support area(s) and resident support utilities during and immediately following a disaster, whichever is greater.

420.4.2.9.3 The fuel supply shall either be located below ground or contained within a protected area that is designed and constructed to meet the structural requirements of this code and debris impact requirements as specified by Sections 1626.2 through 1626.4. If an underground system is used, it shall be designed so as to exclude the entrance of any foreign solids or liquids.

420.4.2.9.4 All fuel lines supporting the generator system(s) shall be protected also with a method designed and constructed to meet the structural requirements of this code and debris impact requirements as specified by Sections 1626.2 through 1626.4.

420.4.2.9.5 All panel boards, transfer switches, disconnect switches, enclosed circuit breakers or emergency system raceway systems required to support the occupied resident area(s), resident support area(s) or support utilities shall be contained within a protected area(s) designed and constructed to meet the structural requirements of this code and debris impact requirements as specified by Sections 1626.2 through 1626.4, and shall not rely on systems or devices outside of this protected area(s) for their reliability or continuation of service.

420.4.2.9.6 The emergency generator(s) shall be air- or self-contained liquid cooled and it and other essential electrical equipment shall be installed in a protected area(s) designed and constructed to meet the structural requirements of this code and debris impact requirements as specified by Sections 1626.2 through 1626.4.

420.4.2.9.7 If the facility does not have a permanent onsite optional stand-by generator to operate the normal branch electrical system, there shall be a permanently installed predesigned electrical service entry for the normal branch electrical system that will allow a quick connection to a temporary electrical generator. This quick connection shall be installed inside of a permanent metal enclosure rated for this purpose and may be located on the exterior of the building.

420.4.2.10 Fire protection standards.

420.4.2.10.1 If the facility requires fire sprinklers as part of its fire protection, either of the following shall be met:

420.4.2.10.1.1 On-site water storage capacity to continue sprinkler coverage, in accordance with the requirements of NFPA 13, *Sprinkler Systems*, fire watch, conducted in accordance with the requirements of Chapter 59A-4, *Florida Administrative Code.*

420.4.2.10.2 If the facility provides a fire watch in lieu of water storage to continue sprinkle coverage, then one 4-A type fire extinguisher or equivalent shall be provided for every three or less 2-A fire extinguishers required by NFPA 10, *Portable Extinguishers*, for the area served. These additional extinguishers shall be equally distributed throughout the area they are protecting.

420.4.2.11 External emergency communications standards. (Reference Chapter 59A-4, *Florida Administrative Code* for requirements.)

SECTION 421
AMBULATORY SURGICAL CENTERS

421.1 Scope.

421.1.1 Ambulatory surgical centers shall comply with all applicable requirements of the code and the following design and construction standards as described herein, and shall have plans reviewed and construction surveyed by the state agency authorized to do so by Chapter 553.80(1)(c), *Florida Statutes*.

NOTE: For project submission and fee requirements, codes and standards for existing facilities, and other administrative, licensure and programmatic provisions for ambulatory surgical centers, see Agency for Health Care Administration [AHCA] Rule 59A-5, *Florida Administrative Code* (F.A.C.) and Chapter 395, *Florida Statutes*.

421.2 Codes and standards for the design and construction of ambulatory surgical centers.

421.2.1 Except as modified and required by this section of the code, Chapter 59A-5 *Florida Administrative Code* or by Chapter 395, *Florida Statutes*, all new ambulatory surgical centers and all additions, alterations or renovations to existing ambulatory surgical centers shall also be in compliance with the following codes and standards on the effective date of the code:

421.2.1.1 The fire codes described in Chapter 69A-3.012, Standards of the National Fire Protection Association Adopted, *Florida Administrative Code.*

421.2.1.2 *The Guidelines for Design and Construction of Health Care Facilities* (the Guidelines), Part 1 General and Part 3 Ambulatory Care Facilities incorporated by reference and obtainable from the American Institute of Architects, 1735 New York Ave., N.W., Washington, D.C. 20006-5292;

421.2.1.3 *Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, Sheet Metal and Air Conditioning Contractors National Association, Inc.* (SMACNA).

421.3 Additional physical plant requirements for ambulatory surgical centers.

421.3.1 In addition to the codes and standards referenced in Section 421.2 of the code, the following minimum standards of construction and specified minimum essential facilities shall apply to all new ambulatory surgical centers and to all new additions, alterations or renovations to existing ambulatory surgical center on the effective date of the code.

421.3.2 Operating rooms. (See The Guidelines for other requirements.)

421.3.2.1 All ambulatory surgical centers shall be equipped with a minimum of one operating room that is in compliance with the requirements of a "Class C" operating room as described in Chapter 9.5.F of The Guidelines.

421.3.2.2 If provided, procedure, examination, or treatment room(s) shall have a minimum clear area of 120 square feet (11.5 m^2) and shall meet only the requirement for an examination/treatment room as described in The Guidelines.

421.3.3 Recovery area. Reserved.

421.3.4 Details and finishes. (See The Guidelines for other requirements.)

421.3.4.1 No doors shall swing into the corridor except those to small closets or small mechanical or electrical rooms that cannot be usefully occupied with the doors in the closed position.

421.3.4.2 All exit access corridor doors must be equipped with automatic positive latching hardware.

421.3.4.3 Permanently installed single service paper towel dispensers and soap dispensers shall be provided at all lavatories and sinks used for handwashing.

421.3.4.4 The use of sliding pocket doors to patient use toilets shall not be permitted.

421.3.5 Elevators where required. (See The Guidelines for other requirements.)

421.3.5.1 *All* new ambulatory surgical centers located in multistory buildings where patient treatment areas are located on other than the exit floor shall have at least one 2,500 pound (933 kg) capacity elevator that shall be in compliance with the requirements of Section 421.3.13.5 of this code and the requirements of Chapter 30 of the code.

421.3.5.2 This required elevator shall be sized to accommodate an ambulance stretcher 76 inches (1931 mm) long and 24 inches (610 mm) wide in the horizontal position. This elevator shall be identified with a sign indicating it as the ambulance stretcher elevator.

421.3.6 Air-conditioning, heating and ventilating systems.

421.3.6.1 Air-handling equipment shall be located either on the roof of the building it serves or in mechanical equipment rooms unless it serves only one room and is located in that room. In buildings with multiple uses, tenants or occupancies, the licensed health care areas required by this code to maintain filter efficiencies and relative air pressure relationships shall be served by separate ducted mechanical air supply, return and exhaust systems.

421.3.6.2 Ventilation shall be provided in all rooms in new and remodeled facilities by mechanical means. Rooms requiring positive or negative relative pressures, shall maintain the air quantities as required between the supply, return or exhaust at a minimum of 75 cfm (2.13 m^3/min) for room areas 100 square feet (9 m^2) or larger and 50 cfm (1.42 cu.m./min.) for rooms less than 100 square feet (9.29 m^2).

421.3.6.3 Variable volume systems shall not be permitted in surgical procedures rooms and recovery rooms.

421.3.6.4 Friable duct linings exposed to air movement shall not be used in ducts, terminal boxes or other systems supplying operating rooms and recovery rooms, unless terminal filters of at least 90-percent efficiency are installed downstream of linings. Flexible duct work shall have a continuous metal inner liner encased by insulating material with an outer vapor jacket conforming to UL 181 unless the flexible duct meets the following criteria:

- The duct conforms to UL Class 1 Air Duct, Standard 181 with minimum rated air velocity of 4,000 feet per minute, and is pressure rated for a minimum of 4-inches water gage positive pressure and 1-inch water gage negative pressure.
- The inner core of the duct is constructed of Chlorinated Polyethylene (CPE) material encircling a steel helix bonded to the CPE.
- The duct has a fire-retardant metalized vapor barrier that is reinforced with crosshatched fiberglass scrim having a permanence of not greater than 0.05 perms when tested in accordance with ASTM E 96 Procedure A.
- The duct has passed an impact test similar to the UL 181 standard, conducted by a nationally recognized testing laboratory (NRTL) except it shall use a 25-pound weight dropped from a height of 10 feet. As a result of the test, the inner and outer surfaces of the sample shall not have ruptured, broken, torn, ripped, collapsed or separated in order for the duct to pass the test. In addition, the helix shall rebound to a cross-sectional elliptical area

not less than 80 percent of the original test sample diameter.

The use of flexible duct shall be limited to flexible air connector applications.

421.3.7 Fan and damper control during fire alarm.

421.3.7.1 During a fire alarm, fan systems and fan equipment shall be stopped to prevent the movement of smoke by mechanical means from the zone in alarm to adjacent smoke zones or to adjacent areas within the smoke zone if there is only one zone in the facility.

421.3.7.2 Fan control shall be designed so as to minimize the interruption of heating, ventilating and air conditioning in compartments remote from the compartment in alarm.

421.3.7.3 Fan control shall not interfere with the continuous operation of exhaust systems conveying ethylene oxide or other hazardous chemicals and fumes or systems required to operate continuously for the health and safety of occupants. Air-handling systems shall be designed to allow for continuous operation of all such systems and to minimize movement of smoke by mechanical means from the zone in alarm.

421.3.8 Plumbing fixtures.

421.3.8.1 Plumbing shall comply with the *Florida Building Code, Plumbing*.

421.3.8.2 All examination or treatment rooms shall be equipped with hand washing facilities.

421.3.8.3 Wall-mounted lavatories and hand washing facilities shall be attached to floor-mounted carriers and shall withstand an applied vertical load of a minimum of 250 pounds (113 kg) on the front of the fixture.

421.3.9 Fire pump.

421.3.9.1 Where required in new construction, fire pumps and ancillary equipment shall be separated from other functions by construction having a 2-hour fire-resistance rating.

421.3.9.2 The fire pump normal service disconnect shall be rated to hold locked rotor current indefinitely. If the approved normal service disconnect is located on the exterior, it shall be supervised by connection to the fire pump remote annunciator and shall provide a separate fire alarm system trouble indication.

421.3.9.3 When the fire pump is placed on the emergency system in addition to the normal supply, the emergency feeder protective device shall be sized in accordance with maximum rating or settings of Chapter 27 of the *Florida Building Code, Building*.

421.3.9.4 The fire pump transfer switch may be either manual or automatic. If located on the line side of the controller as a separate unit, the switch must be rated for the pump motor locked rotor current indefinitely and must be located in the pump room.

421.3.9.5 Combination fire pump controller and transfer switch units listed by the Underwriter's Laboratories, Inc., as prescribed by Chapter 27 of the *Florida Building Code, Building* are acceptable when the transfer switch has exposable and replaceable contacts, not circuit breaker types, rated for the available short-circuit current.

421.3.9.6 The fire pump shall be installed in a readily accessible location When it is located on the grade level floor, there shall be direct access from the exterior.

421.3.10 Electrical requirements. (See The Guidelines for other requirements.)

421.3.10.1 All material, including equipment, conductors, controls, and signaling devices, shall be installed to provide a complete electrical system with the necessary characteristics and capacity to supply the electrical facilities shown in the specifications or indicated on the plans. All materials and equipment shall be factory listed as complying with applicable standards of Underwriter's Laboratories, Inc., or other similarly established standards of a nationally recognized testing laboratory (NRTL) that has been certified by the Occupational Safety and Health Administration (OSHA) for that referenced standard.

421.3.10.2 There shall be documentation for equipotential grounding in all patient care areas, building service ground electrode systems, and special systems such as fire alarm, nurse call, paging, generator, emergency power and breaker coordination.

421.3.10.3 All spaces occupied by people, machinery and equipment within buildings, and the approaches thereto, and parking lots, shall have electric lighting.

421.3.10.4 Patients' recovery rooms shall have general lighting. Fixed lights not switched at the door shall have switch controls convenient for use at the luminaries. All switches for control of lighting in recovery areas shall be of the quiet operating type.

421.3.10.5 Operating rooms shall have general lighting for the room in addition to localized specialized lighting provided by a special lighting unit required at the surgical table. The type of special lighting unit shall be as specified by the functional program of the facility. Each special lighting unit for localized lighting at the surgical table shall be permanently installed and permanently connected to an independent circuit that shall be powered from the critical branch. In addition, a minimum of one general purpose lighting fixture shall be powered from a normal circuit in all operating rooms.

421.3.10.6 Duplex receptacles in operating rooms and post-operative recovery rooms, shall be provided as follows:

421.3.10.6.1 There shall be a minimum of six duplex electrical receptacles for each patient station.

421.3.10.6.2 Four shall be connected to the critical branch of the essential electrical system, and two of the required number shall be connected to dedicated circuits.

421.3.10.6.3 Two shall be connected to a normal power circuit except in anesthetizing locations where two shall be connected to critical power circuits.

421.3.10.6.4 There shall be no more than two duplex receptacles per circuit.

421.3.10.7 All receptacles shall have engraved cover plates to indicate the panel board and circuit numbers powering the device.

421.3.10.8 Branch circuit over-current devices shall be readily accessible to nursing staff and other authorized personnel.

421.3.10.9 Nonmetallic sheathed cable or similar systems are not permitted for power and lighting wiring in any facility.

421.3.10.10 Panel boards located in spaces subject to storage shall have the clear working space per Chapter 27 of the *Florida Building Code, Building*. "ELECTRICAL ACCESS–NOT FOR STORAGE" shall be permanently marked on the floor and wall about the panel. Panel boards shall not be located in egress corridors.

421.3.10.11 Duplex receptacles for general use shall be installed approximately 50 feet (15 240 mm) apart in all general purpose corridors and within 25 feet (7620 mm) of ends of corridors.

421.3.11 Nurses' calling system.

421.3.11.1 In facilities which contain more than eight recovery beds, or where recovery beds are not in direct view from the nurse's station, a nurses' calling system shall be provided. Each recovery bed shall be provided with a call button. Two call buttons serving adjacent beds may be served by one calling station. Call shall activate a visual and audible signal at the nurses' station and in the clean workroom and soiled workroom. Call shall also activate a corridor dome light located at each patient recovery position.

421.3.11.2 A nurses' call emergency system shall be provided at each patient toilet and dressing room. Activation shall be by a pull cord conveniently located for patient use. This system will activate distinct audible and visual signals in the recovery room nurses' station and in the surgical suite nurses' station. The emergency call system shall be designed so that signal light activation will remain lighted until turned off at patient's calling station.

421.3.11.3 A corridor dome light shall be located directly outside of any patient use area that is equipped with a nurse call system.

421.3.12 Fire alarm systems.

421.3.12.1 A fire alarm annunciator panel shall be provided per facility or building at a location that is constantly attended during the facility's hours of operation and shall annunciate a fire alarm from any manual or automatic fire alarm device. The panel shall indicate the zone of actuation of the alarm, and there shall be a trouble signal indicator. Each smoke compartment shall be annunciated as a separate fire alarm zone. A fire alarm system zone shall not include rooms or spaces in other smoke compartments and shall be limited to a maximum area of 22,500 square feet (2090 m^2).

421.3.13 Emergency electric system.

421.3.13.1 A Type 1 essential electrical system shall be provided in ambulatory surgical centers as described in NFPA 99, *Health Care Facilities*. The emergency power for this system shall meet the requirements of a Level 1, Type 10, Class 8 generator as described in NFPA 110, *Emergency Standby Power Systems*.

421.3.13.2 In new construction, the normal main service equipment shall be separated from the emergency distribution equipment by locating it in a separate room. Transfer switches shall be considered emergency distribution equipment for this purpose.

421.3.13.3 Switches for critical branch lighting shall be totally separate from normal switching. The devices or cover plates shall be of a distinctive color. Critical branch switches may be adjacent to normal switches. Switches for life safety lighting are not permitted except as required for dusk-to-dawn automatic control of exterior lighting fixtures.

421.3.13.4 There shall be selected life safety lighting provided at a minimum of 1 footcandle (10 lux) and designed for automatic dusk-to-dawn operation along the travel paths from the exits to the public way or to safe areas located a minimum of 30 feet (9.144 m) from the building.

421.3.13.5 A minimum of one elevator serving any patient treatment floor shall be in compliance with Section 421.3.5 of this code and shall be connected to the equipment branch of the essential electric system and arranged for manual or automatic operation during loss of normal power.

421.3.13.6 If a day tank is provided, it shall be equipped with a dedicated low level fuel alarm and a manual pump. The alarm shall be located at the generator derangement panel.

421.3.13.7 Transfer switch contacts shall be of the open type and shall be accessible for inspection and replacement.

SECTION 422
BIRTHING CENTERS

422.1 Scope. All birthing centers shall comply with the following design and construction standards as described herein.

Note: Other administrative and programmatic provisions may apply. See Agency of Health Care Administration [AHCA] Rule 59A-11, *Florida Administrative Code* and Chapter 383, *Florida Statutes*.

422.2 Physical environment, water supply and fire safety.

422.2.1 At least one birthing room shall be maintained which is adequate and appropriate to provide for the equipment, staff, supplies and emergency procedures required for the physical and emotional care of a maternal client, her support person and the newborn during labor, birth, and the recovery period.

422.2.2 The birth center shall be designed to provide adequate space for the following:

422.2.2.1 Birth rooms shall be located to provide unimpeded, rapid access to an exit of the building which will accommodate emergency transportation vehicles.

422.2.2.2 Adequate fixed or portable work surface areas shall be maintained for use in the birth room.

422.2.2.3 A separate space for a clean area and a contaminated area; if it is not feasible to provide such separate areas, special procedures shall be established for the disposal of infectious waste. Sanitary waste containers, soiled linen containers, storage cabinets and an autoclave, pressure cooker or other effective sterilization equipment shall be available.

422.2.2.4 Prenatal and postpartum examinations which will provide privacy for the patient, hand-washing facilities and the appropriate equipment for staff.

422.2.2.5 Medical record storage, client interviews, instruction and waiting rooms.

422.2.3 Toilet and bathing facilities.

422.2.3.1 A toilet and lavatory shall be maintained in the vicinity of the birth room.

422.2.3.2 Hand-washing facilities shall be in or immediately adjacent to the birth room.

422.2.3.3 A bathtub or shower shall be available for client use.

422.2.3.4 All floor surfaces, wall surfaces, water closets, lavatories, tubs, showers, shall be kept clean, and all appurtenances of the structures shall be of sound construction, properly maintained, in good repair and free from safety hazards.

422.2.4 There shall be provisions and facilities for secure storage of personal belongings and valuables of clients.

422.2.5 There shall be provisions for visual privacy for each maternal client and her support person.

422.2.6 Hallways and doors providing access and entry into the birth center and birth room shall be of adequate width and conformation to accommodate maneuvering of ambulance stretchers and wheelchairs.

422.2.7 All areas of the facility shall be well lighted and shall have light fixtures capable of providing at least 20 footcandles (200 lux) of illumination at 30 inches (762 mm) from the floor to permit observation, cleaning and maintenance. Light fixtures shall be properly maintained and kept clean.

422.2.8 All housing facilities shall have adequate ventilation and be kept free of offensive odors.

422.2.8.1 If natural ventilation is utilized, the opened window area for ventilation purposes shall be equal to one-tenth of the floor space in the residential area.

422.2.8.2 When mechanical ventilation or cooling systems are employed, the system shall be properly maintained and kept clean. Intake air ducts shall be designed and installed so that dust or filters can be readily removed. In residence areas and segregation rooms with solid doors, mechanical ventilation systems shall provide a minimum of 10 cubic feet (.3 m^3) of fresh or filtered recirculated air per minute for each client occupying the area.

422.2.8.3 All toilet rooms shall be provided with direct openings to the outside or provided with mechanical ventilation to the outside.

422.2.9 Adequate heating and cooling facilities shall be provided to maintain a minimum temperature of 68°F (20°C) and maximum temperature of 78°F (26°C) at a point 20 inches (508 mm) above the floor.

422.2.10 All heating devices shall comply with fire prevention provisions found in Rule 69A-3, Fire Prevention, General Provision, *Florida Administrative Code*.

422.2.11 Laundry.

422.2.11.1 Where laundry facilities are provided, laundry facilities shall be of sound construction and shall be in good repair and clean. Adequate space shall be provided and areas shall be designated for the separation of clean and soiled clothing, linen and towels.

422.2.11.2 Laundry rooms shall be well lighted and properly ventilated. Clothes dryers shall be vented to the exterior.

422.2.12 Insect and rodent control. Facilities shall be kept free of all insects and rodents. All outside openings shall be effectively sealed or screened with 16 mesh screening or equivalent to prevent entry of insects or rodents.

422.2.13 Outdoor areas. Outdoor areas shall be well drained. Indoor and outdoor recreational areas shall be provided with safeguards designed for the needs of the residents.

422.2.14 Water supply.

422.2.14.1 Drinking water shall be accessible to all clients. When drinking fountains are available, the jet of the fountain shall issue from a nozzle of nonoxidizing impervious material set at an angle from the vertical. The nozzle and every other opening in the water pipe or conductor leading to the nozzle shall be above the edge of the bowl so that such nozzle or opening will not be flooded in case a drain from the bowl of the fountain becomes clogged. The end of the nozzle shall be protected by nonoxidizing guards to prevent persons using the fountain from coming into contact with the nozzle. Vertical or bubbler drinking fountains shall be replaced with approved type water fountains or be disconnected. When no approved drinking fountains are available, clients shall be provided with single service cups which shall be stored and dispensed in a manner to prevent contamination. Common drinking cups are prohibited.

422.2.14.2 Hot and cold running water under pressure and at safe temperature, not to exceed 110°F (43°C) to prevent scalding, shall be provided to all restrooms, lavatories and bathing areas.

422.2.15 Sewage disposal.

422.2.15.1 All sanitary facilities shall comply with the requirements of the *Florida Building Code, Plumbing.*

422.2.15.2 For facilities with nine or more birth rooms, mop sinks or curbed areas with floor drains shall be available in convenient locations throughout the facility to facilitate cleaning and for the proper disposal of cleaning water.

422.2.16 Fire control. Each birth center shall provide fire protection through the elimination of fire hazards, the installation of necessary safeguards such as extinguishers and smoke alarms to insure rapid and effective fire control.

422.2.16.1 To safeguard all clients, the birth center shall have:

422.2.16.1.1 "No Smoking" signs prominently displayed in those areas where smoking is not permitted.

422.2.16.1.2 Fire regulations and evacuation route prominently posted.

422.2.16.2 The written fire control plan approved by the appropriate local fire authority shall contain provisions for prompt reporting of all fires, extinguishing fires, protection of personnel and guests, evacuation, and cooperation with fire-fighting authorities.

422.2.16.3 New centers' carpeting must comply with the maximum flame spread rating of 75 in accordance with ASTM E 84 test as required under Chapter 69A-3.012 Standards of the National Fire Protection Association Adopted, *Florida Administrative Code.* Those existing centers not having affirmative evidence of complying with such flame spread rating shall establish fire control measures including the prohibition of smoking in carpeted areas. Such procedures shall be approved by the authority having jurisdiction.

SECTION 423
STATE REQUIREMENTS FOR EDUCATIONAL FACILITIES

423.1 Scope: Public educational facilities. Public educational facilities shall comply with the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal. These are minimum standards; boards may impose more restrictive requirements. Additional requirements for public educational facilities in Florida, including public schools and public community/junior colleges, are found in these standards.

Note: Other administrative and programmatic provisions may apply. See Department of Education Rule 6-2 and Chapter 1013, *Florida Statutes.*

423.2 Public schools and community colleges general requirements.

423.2.1 Owner. Each school board and community college board of trustees is deemed to be the owner of facilities within its respective jurisdiction. Boards shall provide for enforcement of the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal, including standards for health, sanitation, and others as required by law.

423.2.2 Exemption from local requirements. All public educational and ancillary plants constructed by a school board or a community college board are exempt from all other state, county, district, municipal, or local building codes, interpretations, building permits, and assessments of fees for building permits, ordinances, road closures, and impact fees or service availability fees as provided in Section 1013.37(1)(a), *Florida Statutes.*

423.3 Code enforcement.

423.3.1 School boards and community college boards. Section 553.80(6), *Florida Statutes*, provides options for plan review services and inspections by school boards and community college boards.

423.3.2 Owner review and inspection. A school board or community college board which undertakes the construction, remodeling, renovation, lease, or lease-purchase of any educational plant or ancillary facility, or day labor project, regardless of cost or fund source, shall review construction documents as required by law in Section 1013.38, *Florida Statutes*, and Section 553.80(6), *Florida Statutes*, and shall ensure compliance with requirements of law, rule, and the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal. Section 553.80(6), *Florida Statutes*, states that district school boards and community college boards shall provide for plan review and inspections for their projects. They shall use personnel certified under Part XII of Chapter 468, *Florida Statutes* to perform the plan reviews and inspections or use one of the options provided in Section 1013.38, *Florida Statutes*. Under this arrangement, school boards and community college boards are not subject to local government permitting, plan review, and inspection fees.

423.3.3 Local government review and inspection. As an option to the owner providing plan review and inspection services, school boards and community college boards may use local government code enforcement offices who will not charge fees more than the actual labor and administrative costs for the plan review and inspections. Local government code enforcement offices shall expedite permitting. Any action by local government not in compliance with Section 553.80(6), *Florida Statutes*, may be appealed to the Florida Building Commission, which may suspend the authority of that local government to enforce the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal on the facilities of school boards and community college boards.

423.3.4 Other regulatory agencies. Boards shall coordinate the planning of projects with state and regional regulatory and permitting agencies, as applicable. Other state or local agencies may inspect new construction or existing facilities when required by law; however, such inspections shall be in conformance with the code as modified by this section.

423.3.5 Day labor projects. Any one construction project estimated to cost $200,000 or less where bonafide board employees or contracted labor provide the work. Day labor projects are subject to the same *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal as new construction.

423.3.6 Routine maintenance. Maintenance projects are subject to the same *Florida Building Code* and *Uniform Fire Safety Standards* as adopted by the State Fire Marshal as new construction. Chapter 489, *Florida Statutes*, exempts boards from the use of a licensed general contractor for projects up to $200,000 where bonafide board employees provide the work. Maintenance projects estimated to cost more than $200,000 and which include construction, renovation and/or remodeling, shall be reviewed for compliance with the code.

423.3.7 Certificate of occupancy. New buildings, additions, renovations, and remodeling shall not be occupied until the building has received a certificate of occupancy for compliance with codes that were in effect on the date of permit application.

423.3.8 Reuse and prototype plans shall be code updated with each new project.

423.4 Reference documents. School Boards and Community College Boards of Trustees. In addition to complying with the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal, and other adopted standards and this section, public educational facilities and sites shall comply with applicable federal and state laws and rules.

423.4.1 Rule 6-2 [*State Requirements for Educational Facilities (SREF)*]. A Florida Department of Education document which includes required design standards, standards for rehabilitation of historical resources, capital outlay project process requirements, and various agencies having jurisdiction during project planning and construction.

423.4.2 FEMA. Federal Emergency management Agency. Rules and Regulations 44 CFR, Parts 59 and 60, Revised as of October 1, 1995. In Flood Zones A1 through A30, AE, AH, and AO (100-year flood plain) the finished floor at the lowest entry level shall be a minimum 1 foot (305 mm) above the base flood elevation.

423.4.3 Florida statutes and state rules. Including, but not limited to, Chapters 1013, 240, 255, 468, 471, 481, 489, 553, 633, and Section 287.055, *Florida Statutes*, and various state rules as applicable to specific projects.

423.4.4 Accessibility requirements for children's environments. U.S. Department of Justice and the U.S. Architectural and Transportation Barriers Compliance Board.

423.4.5 Handbook for public playground safety. Playgrounds and equipment shall be designed and installed using the *Handbook for Public Playground Safety* by the U. S. Consumer Product Safety Commission, and the ASTM/CPSC *Playground Audit Guide* as applicable.

423.4.6 ANSI Z53.1. *American National Standard Safety Color Code for marking Physical Hazards*, is used in shops where machinery requires marking and safety zones.

423.4.7 ASCE 7. American Society of Civil Engineers.

423.4.8 *Life Cycle Cost Guidelines for Materials and Buildings for Florida's Public Educational Facilities*, available from the Department of Education, Bureau of Educational Facilities shall be considered.

423.5 Definitions.

423.5.1 "Assembly" occupancies are buildings or portions of buildings used for gatherings of 50 or more persons, such as auditoriums, gymnasiums, multipurpose rooms, classrooms and labs, cafeterias, stadiums, media centers and interior courtyards. Assembly occupancies include adjacent and related spaces to the main seating area, such as stages, dressing rooms, workshops, lobbies, rest rooms, locker rooms, and store rooms. School board and community college facilities shall follow the requirements of Uniform Fire Safety Standards as adopted by the State Fire Marshal for assembly spaces.

423.5.2 "Board" means a district school board and a community college board of trustees.

423.5.3 "Boiler" is a fuel-fired, heat-producing appliance with a minimum input capacity of (60,000) Btu per hour and intended to supply hot water or steam. Boilers and the inspection of boilers shall comply with the Boiler Safety Act of 1987.

423.5.4 "Certificate of occupancy" is documentation issued by an authority having jurisdiction which indicates inspection and approval of completion of a construction project pursuant to the requirements of Florida law.

423.5.5 "Courtyard" is a court or enclosure adjacent to, or surrounded by, a building(s) and/or walls.

423.5.5.1 "Exterior courtyard" is a courtyard which is not roofed, has a minimum width of 40 feet (1219 mm), and

a. has an opening a minimum width of 40 feet (1219 mm), with no obstructions, on at least one end, or

b. has fences between the buildings for security purposes, and the required exiting capacity of the courtyard is provided for by means of doors or gates from the courtyard.

An exterior courtyard may be considered exterior space and used for exiting of adjacent spaces. For an exterior courtyard with an opening between 40 feet (1219 mm) and 60 feet wide (18 288 mm), the building walls and wall openings must meet the requirements of *Florida Building Code, Building* Tables 601 and 602 and the maximum travel to the courtyard opening/exit shall not exceed 150 feet (45,720 mm) from any point within the courtyard. If the minimum courtyard width exceeds 60 feet (18 288 mm), the travel distance to a courtyard opening/exit may exceed 150 feet (945 720 mm).

423.5.5.2 "Enclosed courtyard" is a courtyard which is not roofed by more than 50 percent of the courtyard area and which is substantially surrounded by a building(s) on two sides or more and each opening to the exterior is less than 40 feet (1219 mm) in width. The courtyard area shall be calculated for maximum occupancy as an assembly space and the number and size of remotely located exits shall be calculated for the maximum possible load. The maximum possible load is the greater of the calculated capacity of the courtyard or the load imposed by the surrounding spaces. An enclosed courtyard may be used as a component of exit access provided that the walls and wall openings meet the requirements of *Florida Building Code, Building* Tables 601 and 602 and the maximum travel to the exit discharge does not exceed 150 feet (45 720 mm) from any point within the enclosed court-

yard. An enclosed courtyard cannot serve as the exterior for exiting or for emergency rescue openings.

423.5.5.3 "Roofed courtyard" is a courtyard which is roofed by more than 50 percent of the courtyard area in any manner. Courtyards may be used for assembly spaces and may not be used as a component of exiting from adjacent spaces.

423.5.6 "Facility" is additionally defined as follows:

423.5.6.1 "Ancillary facility" is a building or other facility necessary to provide district-wide support services, such as an energy plant, bus garage, warehouse, maintenance building, or administrative building.

423.5.6.2 "Ancillary plant" is buildings, site, and site improvements necessary to provide district-wide vehicle maintenance, storage, building maintenance activities, or administrative functions necessary to provide support services to an educational program.

423.5.6.3 "Auxiliary facility" consists of the support spaces located at educational facilities and plants which do not contain student stations but are used by students, such as libraries, administrative offices, and cafeterias.

423.5.6.4 "Educational facility" consists of buildings and equipment, structures, and special educational use areas that are built, installed, or established to serve primarily the educational purposes and secondarily the social and recreational purposes of the community.

423.5.6.5 "Educational plant" comprises the educational facilities, site, and site improvements necessary to accommodate students, faculty, administrators, staff, and the activities of the educational program.

423.5.6.6 "Existing facility" is a facility owned, rented or leased.

423.5.6.7 "Leased facility" is a facility not owned, but contracted for use.

423.5.6.8 "Permanent facility" is a facility designed for a fixed location.

423.5.6.9 "Relocatable/portable facility" is a building which is designed with the capability of being moved to a new location.

423.5.6.10 "Modular facility" is a structure which, when combined with other modules and/or demountable roof and/or wall sections, forms a complete building. This facility may be relocatable.

423.5.7 "Maintenance and repair" is the upkeep of educational and ancillary plants including, but not limited to, roof or roofing replacement, short of complete replacement of membrane or structure; repainting of interior or exterior surfaces; resurfacing of floors; repair or replacement of glass and hardware; repair or replacement of electrical and plumbing fixtures; repair of furniture and equipment; replacement of system equipment with equivalent items meeting current code requirements providing that the equipment does not place a greater demand on utilities, structural requirements are not increased, and the equipment does not adversely affect the function of life safety systems; traffic control devices and signage; and repair or resurfacing of parking lots, roads, and walkways. Does not include new construction, remodeling, or renovation, except as noted above.

423.5.8 "New construction" is any construction of a building or unit of a building in which the entire work is new. An addition connected to an existing building is considered new construction.

423.5.9 "Open plan building" is any building which does not have corridors defined by permanent walls and is entirely open or divided by partitions which may be easily rearranged.

423.5.10 "Open plan instructional space" is an arrangement of two or more class areas with no permanent partitions or wall separations.

423.5.11 "Owner" of facilities within a repective jurisdiction consists of each school board and community college board of trustees is deemed to be the owner of facilities within its respective jurisdiction.

423.5.12 "Permit" for construction is documentation issued by an authority having jurisdiction which indicates approval of construction plans prepared pursuant to the requirements of Florida law.

423.5.13 "Remodeling" is the changing of existing facilities by rearrangement of space and/or change of use. Only that portion of the building being remodeled must be brought into compliance with the *Florida Building Code* and *Uniform Fire Safety Standards* as adopted by the State Fire Marshal unless the remodeling adversely impacts the existing life safety systems of the building.

423.5.14 "Renovation" is the rejuvenating or upgrading of existing facilities by installation or replacement of materials and equipment. The use and occupancy of the spaces remain the same. Only that portion of the building being renovated must be brought into compliance with the *Florida Building Code* and *Uniform Fire Safety Standards* as adopted by the State Fire Marshal unless the renovation adversely impacts the existing life safety systems of the building.

423.5.15 "Separate atmosphere" is the individual volumes of air in a building which are divided by smoke proof barriers to limit contamination of the air by smoke and fumes during a fire.

423.5.16 "Separate building" for the purpose of separate fire alarm systems or sprinkler systems is a structure separated from other buildings by 60 feet (18 288 mm) or more, or as required by other sections of this code.

423.5.17 "Student-occupied space" is any area planned primarily for use by six or more students.

423.6 Administration of public education projects.

423.6.1 Occupancy during construction. School board and community college board facilities, or portions of facilities, shall not be occupied during construction unless exits, fire detection and early warning systems, fire protection, and safety barriers are continuously maintained and clearly marked at all times. Construction on an occupied school board site shall be separated from students and staff by secure barriers. Prior to issuance of the notice to proceed, a safety plan shall be provided by the contractor which clearly delin-

eates areas for construction, safety barriers, exits, construction traffic during the various phases of the project and when conditions change. Where heavy machinery, as is used for earth moving or scraping, is required to work on a school board's occupied site, the work shall be separated from occupants by secure double barriers with a distance of 10 feet (3048 mm) in between. New construction, remodeling or renovations in existing facilities shall not reduce the means of egress below the requirements for new buildings; safe means of egress from a student-occupied space may be accomplished as authorized by NFPA 101, Florida edition as adopted by the *Florida Fire Prevention Code*. New construction (additions) shall not block or reduce safe means of egress.

423.6.2 Contractor toxic substance safety precautions. When hazardous chemicals as defined by 29 CFR 1910.1200, OSHA Hazard Communication Standard are to be used during the maintenance, renovation, remodeling, or addition to an existing facility, the contractor shall notify the administrator in writing at least three working days before any hazardous chemical is used. The notice shall indicate the name of each of the hazardous chemicals to be used, where and when they will be used, and a copy of a Material Safety Data Sheet (MSDS) for each hazardous chemical. The contractor shall comply with the safety precautions and handling instructions set forth in the MSDS. Copies of hazardous waste manifests documenting disposal shall be provided to the facility's administrator who will notify occupants of the anticipated presence of toxic substances during the maintenance, renovation, remodeling, or addition to an existing facility.

423.6.3 Flammable or explosive substances. No flammable or explosive substances or equipment shall be introduced during a remodeling or renovation project in a facility of normally low or ordinary hazard classification while the building is occupied.

423.7 Life safety.

423.7.1 Separate exits. In assembly occupancies, each required exit must exit into a separate atmosphere or to the exterior, to be considered as a separate exit.

423.7.2 Exit access. Exit access shall not be through a toilet room, storage room, or similar space, or any space subject to being locked.

423.7.3 Location of fire extinguishers and blankets. Fire extinguishers may be located inside student-occupied spaces provided they are placed adjacent to the primary exit door, and the room door remains unlocked when the facility is occupied, and a permanently affixed sign, with a red background and white letters, reading "FIRE EXTINGUISHER INSIDE" is placed on the outside adjacent to the door. Fire extinguisher cabinets shall not be locked. Fire blankets shall be located in each laboratory and each shop where a fire hazard may exist. Fire extinguishers and fire blankets shall be readily accessible and suitable for the hazard present and shall not be obstructed or obscured from view. Extinguishers and blankets shall be on hangers or brackets, shelves, or cabinets so that the top of the extinguisher or blanket is not more than 54 inches (1318 mm) above finish floor (AFF) and complies with state and federal accessibility requirements. All extinguishers shall be installed and maintained in accordance with NFPA. Extinguishers shall remain fully charged and operable at all times and have a current tag to indicate compliance.

423.7.4 Common fire alarm. Buildings within 60 feet (18 288 mm) of each other shall have a common fire alarm system. Emergency shelters shall have the fire alarm panel located in the space identified as the shelter manager's office.

423.7.5 Fire alarm sending stations. Sending stations may be located inside student-occupied spaces, adjacent to the primary exit door only if the door to the occupied space is unlocked at all times while the facility is occupied. When located inside a student occupied space, a permanently affixed sign reading "FIRE ALARM PULL STATION INSIDE" shall be placed outside that space adjacent to the door. This sign shall have a red background with white letters. Sending stations shall be mounted to meet accessibility requirements.

423.7.6 Automatic shut off. The fire alarm system shall shut off gas and fuel oil supplies which serve student-occupied spaces or pass through such spaces. The shutoff valve shall be located on the exterior at the service entrance to the building. The shutoff valve shall be of the manual reset type.

423.7.6.1 Kitchen gas supplies. Kitchen gas supplies shall be shut-off by activation of the kitchen hood fire suppression system. The shut-off valve shall be installed in accordance with the manufacturer's instructions and recommendations.

423.7.6.2. Emergency power. The fire alarm system shall not shut off gas supplies which serve emergency power sources.

423.7.7 Unoccupied rooms and concealed spaces. Rooms or spaces for storage, custodial closets, mechanical rooms, spaces under stages with wood structures and other unoccupied or unsupervised spaces in a building shall have automatic fire alarm system detector devices installed. Any concealed space with exposed materials having a flame spread rating greater than Class A, including crawl spaces under floors, interstitial spaces between ceiling and floor or roof above and attic spaces, shall be equipped with heat detector devices. Smoke and heat detector devices shall be installed in accordance with NFPA 72.

423.7.7.1 Fully sprinklered buildings. In fully sprinklered buildings, fire alarm detection devices are not required except where specified in the *Florida Fire Prevention Code*.

423.7.8 Boiler rooms. Each boiler room shall be separated from the remainder of the building by one hour fire rated construction or shall be separate from other buildings by 60 feet (18 288 mm), and shall have an out-swinging door opening directly to the exterior. A fire door swinging into the boiler room shall also be provided for any opening into the interior of the building. There shall be no opening into any corridor or area designed for use by students.

423.8 General requirements for new construction, additions, renovation, and remodeling.

423.8.1 Codes and standards. Educational facilities owned by school boards and community college boards shall meet

the construction requirements of the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal, state and federal laws and rules, and this section for Florida's public educational facilities for new construction, remodeling and renovation of existing facilities. This is a minimum standard; boards may impose more restrictive safety and level of quality standards for educational, auxiliary, and ancillary facilities under their jurisdiction, provided they meet or exceed these minimum requirements.

423.8.1.1 Educational occupancy. School board educational facility projects whether owned, lease-purchased or leased shall comply with the educational occupancy and assembly occupancy portions of the above referenced codes as applicable, except where in conflict with this section. The support spaces such as media centers, administrative offices and cafeterias and kitchens located within educational facilities are not separate occupancies.

423.8.1.2 Business occupancy. Community college board educational facility projects whether owned, lease-purchased or leased shall comply with the business occupancy and the assembly occupancy of the above referenced codes as applicable, except where in conflict with this section.

423.8.1.3 Ancillary facility. School board and community college board ancillary facilities such as warehouses or maintenance buildings, shall use the applicable occupancy section of the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal. Ancillary facilities on educational plant sites shall be separated from the educational facility as required by code.

423.8.2 Space standards. School board and community college board facility sizes shall use standards in the "Size of Space and Occupant Design Criteria Table" found in the Department of Education document, "State Requirements for Educational Facilities (SREF)." Exiting from occupied spaces shall comply with Table 1004.1.2 of the *Florida Building Code, Building.*

423.8.3 Construction type. School board and community college buildings including auxiliary, ancillary and vocational facilities shall comply with the following:

423.8.3.1 Noncombustible Type I, II or IV. The minimum construction type for one- and two-story public educational facilities shall be noncombustible Type I, II or IV construction or better.

423.8.3.1.1 Interior nonload-bearing wood studs or partitions shall not be used in permanent educational and auxiliary facilities or relocatable buildings.

Exception: Historic buildings to maintain the fabric of the historic character of the building.

423.8.3.2 Type I. Facilities three stories or more shall be Type I construction.

423.8.3.3 Type IV. When Type IV construction is used, wood shall be exposed and not covered by ceilings or other construction.

423.8.3.4 Exceptions to types of construction:

1. Covered walkways open on all sides may be Type V construction.
2. Single story dugouts, press boxes, concession stands, related public toilet rooms, detached covered play areas, and nonflammable storage buildings that are detached from the main educational facility by at least 60 feet (1829 mm), may be Type V construction.

423.8.4 Standards for remodeling and/or renovation projects. Portions of buildings being remodeled and/or renovated shall be brought into compliance with current required *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal as required by the plan review authority in its best judgment.

423.8.5 Leased facilities. Leased facilities shall be brought into compliance with applicable occupancy requirements of the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal prior to occupancy.

423.8.6 Asbestos prohibited. The federal Asbestos Hazard Emergency Response Act, (AHERA) 40 CFR, Part 763, as revised July 1, 1995, prohibits the use of any asbestos containing materials in any public education construction project and requires certification of same by the architect of record.

423.8.7 Life cycle cost guidelines for materials and building systems. An analysis shall be included, as required by Section 1013.37(1), *Florida Statutes*, which evaluates building materials and systems, life cycle costs for maintenance, custodial, operating, and life expectancy against initial costs, as described in Section 1013(1)(e)4, *Florida Statutes*. Standards for evaluation of materials are available from the department in a publication entitled *Life Cycle Cost Guidelines for materials and Building Systems for Florida's Public Educational Facilities.*

423.8.8 Safe school design. School boards should design educational facilities and sites including pre-K through 12, vocational and community colleges to enhance security and reduce vandalism through the use of "safe school design" principles. Safe school design strategies are available from DOE/educational facilities and include but are not limited to the following:

423.8.8.1 Natural access and control of schools and campuses.

423.8.8.2 Natural surveillance of schools and campuses both from within the facility and from adjacent streets by removing obstructions or trimming shrubbery.

423.8.8.3 School and campus territorial integrity; securing courtyards, site lighting, building lighting.

423.8.8.4 Audio and motion detection systems covering ground floor doors, stairwells, offices and areas where expensive equipment is stored.

423.8.8.5 Designs which will promote the prevention of school crime and violence. Exterior architectural features which do not allow footholds or handholds on exterior walls, tamperproof doors and locks, nonbreakable glass or shelter window protection system; also landscaping and tree placement should be designed so they do not provide access to roofs by unauthorized persons. Sections of schools commonly used after hours should be separated by doors or other devices from adjacent

areas to prevent unauthorized access. Install locks on roof hatches; apply slippery finishes to exterior pipes.

423.8.8.6 Exterior stairs, balconies, ramps, and upper level corridors around the perimeter of buildings should have open-type handrails or other architectural features to allow surveillance.

423.8.8.7 Open areas, such as plazas, the building's main entrance, parking lots, and bicycle compounds should be designed so they are visible by workers at workstations inside the buildings.

423.9 Structural design.

423.9.1 Load importance factor. Structural design shall comply with code requirements and wind loads as stipulated by the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal. Design shall be based on ASCE 7, with a wind load importance factor for educational facilities of 1.15.

423.10 Site requirements.

423.10.1 Fencing. Fencing for school board educational plants shall be of a material which is nonflammable, safe, durable, and low maintenance, provides structural integrity, strength and aesthetics appropriate for the intended location. Fence heights shall be in compliance with local zoning regulations. Access shall be provided for maintenance machinery. Prohibited materials for nonagricultural educational plants include razor wire, barbed wire and electrically charged systems.

423.10.1.1 Required locations. Fencing is required to separate students from potential harm, and shall be provided in the following locations:

423.10.1.1.1 Kindergarten through grade 12. Exposed mechanical, plumbing, gas, or electrical equipment located on ground level.

423.10.1.1.2 Kindergarten through grade 5. Special hazards as identified by the authority having jurisdiction including retention ponds whose permanent water depth or whose water depth over a 24-hour period exceeds 1 foot (305 mm), deep drainage ditches, canals, highways, and play fields adjacent to roadways.

423.10.1.1.3 Kindergarten through grade 12. All child care and kindergarten play areas.

423.10.2 Walks, roads, drives, and parking areas. Walks, roads, drives, and parking areas on educational and ancillary sites shall be paved. Roads, drives, and parking areas shall be in compliance with Department of Transportation (DOT) road specifications and striped in compliance with DOT paint specifications. All paved areas shall have positive drainage.

423.10.2.1 Covered walks. All buildings in K-12 educational facilities shall be connected by paved walks and accessible under continuous roof cover. New relocatable classroom buildings shall be connected to permanent buildings by paved covered walks where applicable. Roofs for covered walks shall extend 1 foot (305 mm) beyond each side of the designated walkway width. Gutters or other water funneling devices shall prevent storm water from pouring onto or draining across walks.

423.10.2.2 Accessible walks and bridges. Accessible walks shall connect building entrance(s) to accessible parking, public transportation stops, public streets, sidewalks, loading and drop-off zones, and other facilities within the site as required by the accessibility standards. School board sites where educational plants are separated by highways shall be connected by overhead pedestrian bridges.

423.10.2.3 Drainage. Soil, grass, and planting beds shall provide positive drainage away from sidewalks, but shall not fall away at more than a 3-percent gradient slope for a minimum distance of 5 feet (1524 mm) from the edge. The location of all drains, grates, drop inlets, catch basins, other drainage elements and curb cuts shall be out of the main flow of pedestrian traffic.

423.10.2.4 Vertical drops. Walls, railings, or other physical barriers which are at least a minimum 12 inches (305 mm) in height, shall define and protect any vertical drop between joining or abutting surfaces of more than 6 inches (152 mm) but less than 18 inches (457 mm) in height. Any vertical drop of 18 inches (457 mm) or more shall be protected by a wall or guardrail a minimum of 42 inches (1067 mm) in height.

423.10.2.5 Roads and streets. Educational and ancillary site access shall consist of a primary road and another means of access to be used in the event the primary road is blocked. Stabilized wide shoulders of the primary road, unobstructed by landscaping, planters, light fixtures, poles, benches, etc., which allow a third lane of traffic, may satisfy the requirement for the other means of access. Driveways shall not completely encircle a school plant, to allow student access to play areas without crossing roads; vehicular and pedestrian traffic shall not cross each other on the site; bus driveways and parent pick-up areas shall be separated.

423.10.2.6 Bus drives. Bus drives on educational sites shall be designed so that buses do not have to back up. The minimum width shall be 24 feet (7315 mm) for two-lane traffic. The turning radius on educational and ancillary sites and for turning off public access streets shall be as follows: one-way traffic, 60 feet (18 288 mm) minimum measured to the outside curb or edge of the traffic lane; two-way traffic, 60 feet (18 288 mm) minimum measured to the centerline of the road.

423.10.2.7 Vehicle parking areas. Vehicle parking areas shall comply with minimum parking space requirements in this section. Except for parking space requirements to meet federal and state accessibility laws, where alternate transportation or parking arrangements are available the parking area requirements may be reduced from these standards if sufficient justification documentation is provided and if the review authority approves the reduction based on the justification. Overflow parking areas may utilize alternative parking surfaces which facilitate water absorption rather than runoff when approved for use by the review authority.

This requirement usually applies to a percentage of the parking spaces, not all of them.

Exception: Accessible parking spaces shall be hard surface.

423.10.2.8 Minimum parking requirements.

423.10.2.8.1 Faculty and staff. One space for each member.

423.10.2.8.2 Visitors. One space for every 100 students.

423.10.2.8.3 Community clinics where provided. Ten spaces, including one accessible space.

423.10.2.8.4 High schools. One space for every 10 students in grades 11 and 12.

423.10.2.8.5 Vocational schools. One space for every two students.

423.10.2.8.6 Community colleges. One space for every two students.

423.10.2.8.7 Accessible parking. Parking spaces designated for persons with disabilities shall comply with the ADA, Chapter 11 of the *Florida Building Code, Building*, and Section 316.1955, *Florida Statutes*.

423.10.3 Site lighting required. Design, construction, and installation of exterior security lighting for educational and ancillary facilities shall be provided for:

423.10.3.1 Auto, bus, and service drives and loading areas.

423.10.3.2 Parking areas.

423.10.3.3 Building perimeter.

423.10.3.4 Covered and connector walks between buildings and between buildings and parking.

423.10.3.5 Lighting for parking areas. Parking area lighting standards shall be designed to withstand appropriate wind loads. Parking areas shall be illuminated to an average maintained horizontal footcandle, measured at the surface as follows:

423.10.3.5.1 Parking areas–1 footcandle (10 lux).

423.10.3.5.2 Covered and connector walks–1 footcandle (10 lux).

423.10.3.5.3 Entrances/exits –2 footcandles (20 lux).

423.10.3.6 Building exteriors. Building exteriors, perimeters, and entrances may be illuminated to the minimum number of footcandles, measured at the surface with a suggested uniformity ratio of 2:1 as follows:

423.10.3.6.1 Entrances–5 footcandles (50 lux).

423.10.3.6.2 Building surrounds–1 footcandle (10 lux).

423.10.3.7 Shielding. Exterior lighting shall be shielded from adjacent properties.

423.10.4 Building setbacks. Building setbacks from the property line, including relocatables, shall, at a minimum, be 25 feet (7620 mm) or shall comply with local setback requirements if less than 25 feet (7620 mm).

423.10.5 School board playgrounds, equipment, and athletic fields. Playgrounds, equipment, and athletic fields shall be accessible, compatible with the educational facility served and shall comply with the following:

423.10.5.1 Kindergarten play areas shall be separated from other play areas, fenced, and shall be directly accessed from the kindergarten classrooms.

423.10.5.2 Playgrounds and equipment shall be designed and installed using the *Handbook for Public Playground Safety* by the U.S. Consumer Product Safety Commission, and the ASTM/CPSC *Playground Audit Guide* as applicable, resulting in facilities which are safe, structurally sound, verminproof, and do not have jagged or sharp projections.

423.10.5.3 Direct access from the school buildings shall be provided to play areas and athletic fields without crossing public roads, on-site traffic lanes, and parking lots.

423.10.5.4 Related facilities such as toilets, concessions, storage, shower and locker rooms, bleachers, press boxes, observation platforms, scoreboards, and dugouts shall be designed to meet code requirements and the occupant capacity anticipated for the program.

423.10.6 Exterior signage. All permanent and free-standing exterior signs shall be designed to withstand appropriate wind loads. Illuminated signs shall comply with the electrical and installation requirements of the *Florida Building Code* and *Uniform Fire Safety Standards* as adopted by the State Fire Marshal.

423.10.6.1 Site signage shall not create visual barriers at entrances, sidewalks, roads or road intersections.

423.10.6.2 Accessible routes, including parking, building directories, building identification, and accessible entrances shall be marked by exterior signage in conformance with federal and state accessibility laws.

423.10.7 Landscaping. Refer to Section 1013.64(5), *Florida Statutes*, for school board and community college requirements. Xeriscape is defined in Section 373.185, *Florida Statutes*.

423.10.8 Transmission line right-of-way. Buildings, play areas, and common use areas shall not be located within a high-voltage power transmission line right-of-way.

423.10.9 School site master plan. New schools planned after the effective date of these standards shall include, as applicable: facility design capacity; floodplain locations; covered accessible walks; infrastructure locations for, and extensions of, technology, telephone, electricity, fire alarm; and, where applicable, water and sewer utilities, and relocatables.

423.11 Wood: fire-retardant treated wood (FRTW). FRTW shall not be used in permanent educational facilities.

Exception: Only FRTW which does not contain ammonium phosphates, sulfates, or halides, may be used in roof structures of noncombustible Type II ancillary facilities as allowed by the *Florida Building Code*, but only under the following conditions:

423.11.1 Fire-retardant treated wood. All FRTW must meet the requirements of Section 2303.2.

423.11.2 Inspection access panels shall be provided for annual inspection of the condition of the structure and the connectors.

423.11.3 Evidence of compliance shall be provided.

423.12 Roofing.

423.12.1 Class A materials. All roofing materials shall be labeled Class A per ASTM E108 and shall be certified by a nationally recognized independent testing laboratory. All roofing systems shall be installed within the limitations of the test procedure for surfacing, deck cross slope, and combustibility.

423.12.2 Insulation and moisture protection. Insulation, moisture protection, roofing, thermal requirements, fireproofing and firestopping shall be designed and constructed in compliance with the the *Florida Building Code* and *Uniform Fire Safety Standards* as adopted by the State Fire Marshal. Cellulose insulation may only be used if it is treated with fire-retardant borate based chemicals; the contractor shall retain bag labels on site for review by building inspector.

423.12.3 Phased installation prohibited. All new installed materials shall be sealed from moisture penetration at the end of each day. The contractor shall provide the architect/engineer (A/E) of record a "final statement of compliance" for the board.

423.12.4 Manufacturer's one-year inspection. The roof shall be inspected by the manufacturer's representative within one year of acceptance by the board.

423.13 Doors and windows.

423.13.1 Doors. All spaces with an occupant load of six or more students, regardless of use, shall have a door opening directly to the exterior, or as required in the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal, in buildings of three stories or less shall have a rescue window opening directly to the exterior, or shall be fully sprinklered. All doors and gates from spaces with an occupant load of six or more students, regardless of use or location, shall swing in the direction of exit travel, shall be of the side hinged type, and shall always be operable from the inside by a single operation and without a key.

423.13.1.1 Doors for steam rooms, locker rooms, shower rooms and group toilet rooms shall swing in the direction of exit travel, and shall always be operable for exiting from the inside.

423.13.1.2 No mirrors, draperies, curtains, equipment, furnishings, decorations, or other objects which may confuse, obstruct, or conceal the exit or the direction of exit shall be placed to obstruct a means of egress.

423.13.2 Recessed. Doors when fully opened shall not extend into the required exit width of corridors, except for door thickness and required hardware. Doors may either be recessed and hinged to swing 90 degrees, or if flush with corridor wall shall contain a view panel and be hinged to swing 180 degrees.

423.13.3 Special function doors. Special function doors, including balanced doors and overhead doors, shall not be used in a means of egress.

423.13.4 Overhead and sliding security grilles. Security grilles shall have an adjacent side-hinged door swinging in the direction of exit and readily opened from the inside.

423.13.5 Gates. Gates used to secure buildings or used for egress shall be side-hinged and readily opened from the side from which egress is to be made without the use of a key or special tool, or shall have a adjacent side hinged door, or doors as required for occupant load, swinging in the direction of exit and readily opened from the inside without a key.

423.13.6 Hardware. Doors and gates shall be equipped with hardware which will allow egress at all times without assistance. No padlock, chain, hasp, lock, deadbolt, or other device shall be installed at any time on any door used for exiting. Doors which by code require closers and other doors subject to wind exposure shall be equipped with closers to prevent slamming and uncontrolled opening. All doors opening into smoke-tight exit access corridors shall be self-closing or automatic closing. Smoke doors in walls used to divide corridors into separate atmospheres shall be provided with push-pull plates and are not required to have positive latching. As an exception to Section 1008.1.8.6, delayed egress locks may be used in media centers, alternative education centers, and exceptional student education centers. Delayed egress locks are prohibited at time-out rooms at all locations.

423.13.7 Safety glazing: Panels and storefronts. In addition to the requirements of Section 2406.3, the following is considered a hazardous location and requires safety glazing: Glazed panels within 48 inches (1219 mm) of a door, excluding transoms or vertical panels above 6 feet 8 inches (2031 mm).

423.13.7.1 All glazing in hazardous locations shall be safety glazing meeting the requirements of the *Florida Building Code, Building*, Section 2406.

423.13.7.2 Large glass panels shall be subdivided by a built-in horizontal member or a permanent chair rail not less than 1½ inches (38 mm) in width, located between 24 and 36 inches (610 and 914 mm) above the floor.

423.13.8 Windows.

423.13.8.1 Natural light and ventilation. Natural light and ventilation requirements for new construction shall be satisfied by windows with operable glazing, providing a net free open area equivalent to 5 percent of the floor area, in all classrooms on the perimeter of buildings, where required by Chapter 1013, *Florida Statutes*. Auxiliary spaces, music rooms, gyms, locker and shower facilities, laboratories requiring special climate control, and large group instructional spaces having a capacity of more than 100 persons need not have operable windows for the purpose of providing natural light and ventilation. Emergency access, emergency rescue, and secondary means of egress windows may be included in the calculation to comply with this requirement.

423.13.8.2 Projecting and awning windows. Projecting and awning windows shall not be located below door head height if in, or adjacent to, a corridor or walkway.

423.13.8.3 Security/storm screens or grills. If a security/storm screen or grille is installed on the outside of an emergency access, rescue or egress window assembly then that security/storm screen or grille together with the emergency rescue window assembly shall be operable from the inside by a single operation without the use of tools to allow for exit under emergency conditions. The emergency rescue window shall be identified by signage, and the release device shall be readily identifiable.

423.14 Special safety requirements.

423.14.1 Master control switch. In addition to the regular main supply cut-off, each laboratory type space (such as biology, industrial, chemistry, physics, home economics, and electronics labs) equipped with unprotected gas cocks, compressed air valves, water or electric services which are easily accessible to students, shall have master control valves or switches with permanently attached handles, located and accessible within 15 feet (4572 mm) of the instructor's station or adjacent to the door within that space to allow for emergency cut-off of services. The cut-offs shall be in a nonlockable place and the location and operation shall be clearly labeled. Valves shall completely shut off with a one-quarter turn. Computer labs are exempted from this requirement. (Also, see "Emergency shut off switches," and "Emergency disconnects" requirements under "Electrical.")

423.14.2 Interior signage. Signage is required in educational and ancillary facilities. Design, construction, installation, and location of interior signage and graphics shall comply with the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal and the following:

423.14.2.1 Emergency rescue windows: Windows for emergency rescue shall comply with NFPA 101, Florida Edition, as adopted by the *Florida Fire Prevention Code*, shall be operable from the inside by a single operation, and shall be labeled "EMERGENCY RESCUE–KEEP AREA CLEAR."

423.14.2.2 Maximum capacity signs in each space with a capacity of 50 or more occupants. The signs shall be mounted adjacent to the main entrance door.

423.14.2.3 Room name, room number and, if different, FISH inventory numbers shall be provided for each space.

423.14.2.4 A graphic diagram of primary and emergency evacuation routes shall be posted adjacent to the primary exit door from each space occupied by six or more students. The diagram shall clearly indicate, by contrasting color and number, each route of evacuation.

423.14.2.5 Signs necessary to meet accessibility requirements shall be provided.

423.14.2.6 Hazardous work and storage areas shall be identified by appropriate caution signs.

423.14.3 Other potential hazards. Pipes, ductwork, fans, light fixtures, window projections, protruding sharp corners, or other potential hazards shall not be installed below 6 feet 8 inches (2031 mm) AFF. Audio/visual aids in classrooms may be mounted below 6 feet 8 inches (2031 mm) provided they are marked and padded in accordance with accepted safety standards or have permanent cabinets installed below them.

423.14.4 Storage shelving. Shelving shall not have sharp corners, splinters, or any construction feature that would be hazardous to the occupants. Shelving shall be constructed to carry the loads imposed. Shelving in science, labs, and shop storage rooms, and other places which may contain hazardous materials shall have a $^1/_2$ inch (12.7 mm) lip on the front edge of each shelf and shall be constructed of noncorrosive material.

423.14.5 Vertical platform lifts and inclined wheelchair lifts. The following standards are in addition to the other requirements of the *Florida Building Code*, Florida law, and federal requirements:

423.14.5.1 Lifts shall not reduce the width of required means of egress.

423.14.5.2 Lifts shall have shielding devices to protect users from the machinery or other hazards and obstructions.

423.14.5.3 Lifts shall be key operated for attendant operation in all facilities housing kindergarten to grade 8.

423.14.5.4 Inclined wheelchair lifts may be installed in facilities provided:

423.14.5.4.1 The platform is equipped with bidirectional ramp sensing to stop travel if obstructions are encountered.

423.14.5.4.2 Guide rails are smooth and continuous with no sharp edges or obstructions, all drive system components contain safety features for protection of users, and cables and pulling devices are shielded.

423.14.6 Color code machinery. Working machinery with component parts shall be color-coded per ANSI Z53.1, *American National Standard Safety Color Code for marking Physical Hazards.* Safety zone lines shall be marked on the floor areas surrounding working machinery.

423.14.7 Anchor equipment. All equipment designed to be permanently mounted shall be securely anchored to its supporting surface.

423.14.8 Interior finishes.

423.14.8.1 Floors. Floors in instructional spaces shall be covered with resilient material or carpet. Floors in gymnasium locker rooms, showers, drying areas, toilet rooms, kitchens, scullerys, food storage areas and can wash areas shall be impervious.

423.14.8.2 Walls. Walls in toilet rooms shall be impervious to a height of at least 4 feet (1219 mm) above the floor. Walls in kitchens, scullerys, can wash areas, shower rooms shall be impervious to a height of at least 6 feet (1829 mm) above the floor. Toilet and shower partitions shall be impervious.

423.14.8.3 Ceilings. Ceilings in group toilet rooms, kitchens, scullerys, can wash areas, showers and locker rooms shall be impervious.

423.15 Mechanical.

423.15.1 Gas and fluid piping.

423.15.1.1 Flammable liquids/gases. Piping systems for flammable liquids or gases shall not be installed in interior corridors or stairwells.

Exception: Piping may be located within corridors provided that they are enclosed in a minimum 1-hour fire-rated enclosure.

423.15.1.2 Piping systems. Piping (fluid system) shall not be run where students can access the pipes, or in areas such as on roofs where they can be damaged by routine or periodic maintenance activities.

423.15.1.3 Main supply valve. The main supply cut-offs for flammable liquids or gases shall shut down upon activation of the fire alarm system. Refer to the automatic shutoff requirements of Section 423.7.6.

423.15.2 Air plenums. Corridors shall not be used as a supply, return, exhaust, relief, or ventilation air plenum. The space between the corridor ceiling and the floor or roof structure above, if used as a plenum, shall be constructed with the ceiling, floor and walls as a minimum 1-hour fire-rated assembly or as a 1-hour fire-rated horizontal wall supported by the corridor walls.

Exception: A smoke-tight corridor with a solid ceiling may be used in a fully sprinklered building.

423.15.3 Residential equipment. In home economics instructional spaces, faculty lounges, and similar areas where small residential-type ranges are installed for staff use or student education, residential-type hoods mechanically exhausted to the outside shall be used. Hood fire suppression systems are not required to be installed.

423.15.4 Toilet rooms shall be continuously ventilated during building occupancy.

Exception: Individual toilet rooms shall be ventilated continuously during building occupancy or ventilation shall turn off with the light switch and run for at least 10 minutes after the light has been turned off.

423.15.5 Chemistry laboratories and science classrooms. HVAC systems in chemistry labs and science classrooms shall be designed and installed to ensure that chemicals originating from the space are not recirculated.

Exception: A high capacity emergency exhaust system providing twenty (20) air changes per hour may be used in chemistry laboratories and science classrooms with fume hoods. Positive ventilation may be provided via doors or windows opening to the exterior. Signs providing operational instructions shall be permanently installed at the emergency exhaust system fan switch and adjacent to the door(s) or window(s) to be opened.

423.15.6 Ventilation air make-up for HVAC systems. Where peak occupancies of less than 3 hours duration occur, the outdoor air flow may be determined on the basis of average occupancy for school buildings for the duration of operation of the air-conditioning system, provided the average occupancy used is not less than one-half the maximum.

423.16 Plumbing.

423.16.1 Standards. Educational and ancillary facilities shall be provided with toilets, hand washing facilities, and drinking fountains for all occupants, in ratios and accessible as required by the *Florida Building Code*, Florida law, and federal requirements.

Exception: A single unisex toilet room is allowed where provided in child care, pre-kindergarten through grade 3 and ESE classrooms. Unisex toilets shall not be provided in addition to group toilets in assembly occupancies.

423.16.1.1 Assembly occupancies. Toilet facilities for assembly occupancies (i.e. media centers, gymnasums, cafetoriums, and auditoriums) are not required to be in addition to the overall required plumbing fixture count.

423.16.1.2 Location. Student toilets shall be distributed throughout the facility and located on each floor for convenient access and continuous supervision. The path of travel to the nearest toilet facility shall not exceed a distance of 200 feet.

423.16.2 Teacher toilets. In school board facilities, faculty and staff toilets shall be separate from student toilets.

Exception: Separation of faculty/staff and student toilet facilities is not required for community colleges.

423.16.3 Public shelter. Refer to the public shelter design criteria of Section 423.25.

423.16.4 Urinals. Trough urinals shall not be installed in any location.

423.16.5 Floor drains and hose bibbs. All group toilet rooms shall be provided with at least one floor drain and one easily accessible hose bibb. The floor shall be sloped down to the drain. Stall urinals shall not serve as the required floor drains.

423.16.6 Shielding device. The entry to each group toilet room shall be provided with a door, partition, or other shielding device to block from view the occupants in the toilet room. If a door is provided, it shall have a closer and shall swing out in the direction of exit. Exterior entries to toilet rooms shall have outward swinging doors.

423.16.7 Hot water. When hot water is supplied to showers, handwash sinks, lavatories in toilet rooms, a mixing valve shall be installed to control the temperature which shall not exceed 110°F (43°C).

423.16.8 Delayed closing valves. Water supply at toilet room lavatories shall be controlled by delayed-closing valves.

423.16.9 Shower facilities. Showers shall be provided only where required by the district's educational program and, where provided, shall utilize energy saving concepts for hot water as required by Section 1013.44(2), *Florida Statutes*. When provided, shower areas shall comply with the following:

423.16.9.1 Floor finish shall be slip resistant.

423.16.9.2 Floors shall be drained in such a manner that waste water from any shower head will not pass over areas occupied by other bathers.

423.16.9.3 Water shall be heated and the temperature at the shower head shall not exceed 110°F (43°C) nor be less than 95°F (35°C).

423.16.9.4 A master control valve shall be provided to control the shower heads. Showers shall be equipped with flow control devices to limit total flow to a maximum of 3 gpm (-19 L/s) per shower head.

423.16.9.5 Shower heads shall be based on the peak load to be accommodated at one time and provided at the ratio of one shower head for each five students, located a minimum of 30 inches (762 mm) apart.

423.16.10 Kitchens. Kitchens and food service areas shall be provided with toilet and hand washing facilities for employees as required by code, state rule and statute.

423.16.10.1 Toilet rooms shall be completely enclosed, have self-closing doors, and shall open into vestibules with self-closing doors. Toilet rooms shall not open directly into food preparation areas, serving areas, or dining areas. A minimum of one water closet and one lavatory, with hot and cold water, shall be provided in each staff toilet.

423.16.10.2 Floor drains. Floor drains shall be provided in the food serving area, kitchen area, scullery, garbage and rubbish rooms, and can wash area.

423.16.11 Dousing shower and eye wash. Every science room, lab, or shop where instructors and students handle materials or chemicals potentially dangerous to human tissue shall be provided with a dousing shower and eye wash for emergency use, including a floor drain.

423.16.12 Floor drains and plumbing fixtures in equipment rooms. No floor drain or other plumbing fixture shall be installed in a room containing air handling machinery when such room is used as a plenum. When rooms are used as a plenum, equipment drains shall be conveyed through an indirect waste receptor located outside such rooms or other approved point of disposal.

423.17 Electrical.

423.17.1 Emergency lighting. Emergency lighting shall be provided at internal and external means of egress, in student-occupied areas, in group toilets, and main electrical rooms.

423.17.2 Electrical rooms and closets. Main service panels and switches, electrical distribution panels, cabinets, and rooms shall be lockable and not readily accessible to teachers or students.

423.17.3 Spare capacity. Lighting and power panels shall be provided with a minimum of 20-percent spare breakers and a minimum of 10-percent spare capacity in all main panels and switchboards.

423.17.4 Emergency shutoff switches. Every laboratory space which has electrical receptacles at student workstations shall have an emergency shutoff switch within 15 feet (4572 mm) of the instructor's workstation. The emergency shut off switch shall be operable by a single motion and shall interrupt power to all receptacles in the room.

Exception: Emergency shutoff switches are not required in computer laboratories.

423.17.5 Emergency disconnect. Each space equipped with electrically powered machinery accessible to students shall have a minimum of two master emergency disconnect switches at convenient locations within the space to shutoff all power tool outlets, power to student accessible machines and receptacles in the shop. One emergency shutoff or disconnect switch shall be located near the machinery and one emergency shutoff or disconnect switch shall be located in the instructor's office if there is a clear view of the entire shop area, others may be required and located as determined by the authority having jurisdiction. The emergency disconnect or shutoff switch shall be operable by a single motion.

Exception: Ordinary office machines, computers, sewing machines, potter's wheels, residential cooking equipment in home economics labs and other nonhazardous machines do not require emergency disconnect devices.

423.17.6 Sauna and steam rooms. A "panic" switch to deactivate power to heating equipment shall be provided inside sauna and steam rooms. The panic switch shall also be tied into an alarm or other approved warning device in a supervised space in the area of the sauna and/or steam room. The operation of the switch shall be labeled to indicate the intended function.

423.17.7 Lightning. All facilities in high lightning risk areas shall be evaluated using the *Risk Assessment Guide* in NFPA 780 and other standards which address lightning protection, and shall be protected accordingly.

423.17.8 Ground fault interrupter (GFI) receptacles. GFI receptacles shall be installed as required by NFPA 70 of Chapter 27 and in the following locations:

1. All elementary special needs classroom receptacles.
2. All building entry vestibule receptacles.
3. All mechanical, boiler and electrical rooms receptacles.

423.18 Assembly occupancies in public educational facilities.

423.18.1 Occupant capacity of an assembly occupancy shall be calculated as follows:

423.18.1.1 Auditorium. The number of fixed seats, including accessible seating, in the main seating area plus the stage at 15 net square feet (1.4 m^2) per person, plus dressing rooms at 20 net square feet (2 m^2) per person.

423.18.1.2 Gymnasium/gymnatorium with stage. The number of fixed and telescopic bench-type bleacher seats at 18 linear inches (457 mm) per person, including accessible seating, plus the main court area at 15 gross square feet (1.4 m^2) per person, plus locker rooms at 5 net square feet (.5 m^2) per person, plus stage at 15 net square feet (1.4 m^2) per person, plus dressing rooms at 20 net square feet (2 m^2) per person. Bleachers shall be accessible as required.

423.18.1.3 Dining rooms/cafetorium with stage/multipurpose room. The main floor area at 15 gross square

feet (1.4 m^2) per person, plus the stage at 15 net square feet (1.4 m^2) per person, plus dressing rooms at 20 net square feet (2 m^2) per person, plus the kitchen at 100 gross square feet (9 m^2) per person.

423.18.1.4 Classrooms and labs. Exiting capacity for classrooms shall be calculated at 20 net square (2 m^2) feet per occupant. Exiting capacity for laboratories shall be calculated at 50 net square feet (5 m^2) per occupant. If spaces are combined through the use of folding partitions, the capacity and exiting shall be based on the capacity of all the spaces joined.

423.18.1.5 Stadiums. The number of fixed bench-type bleacher seats at 18 linear inches (457 mm) per person, plus accessible seating.

423.18.1.6 Media centers. The reading room and stacks floor area at 36 net square feet (3.3 m^2) per person, plus small group room or area (view and preview) at 5 net square feet (.5 m^2) per person.

423.18.1.7 Closed circuit television production, distribution, and control. The main floor area at 15 net square feet (1.4 m^2) per person.

423.18.1.8 Interior courtyards. The interior courtyard area at 15 gross square feet (1.4 m^2) per person. Raised, dedicated landscape areas may be deducted.

423.19 Shade and green houses.

423.19.1 General. Shade/green houses shall be of Type I or II construction (metal frame) capable of withstanding the appropriate wind load.

423.19.2 Unrestricted exiting. The location of the shade/green house shall not hinder exiting from new and/or existing structures.

423.19.3 Required doors. A minimum of two doors remotely located shall be provided. Doors shall be side hinged and shall swing in the direction of egress.

423.19.4 Accessibility. Green houses shall meet accessibility requirements. The accessible walkway shall be connected to doors leading to an accessible route to the permanent structure.

423.19.5 Shade cloth. Shade cloth shall be tear-away fabric securely fastened to the structural frame.

423.19.6 Fire extinguisher. A minimum of one Type 2A-10B:C fire extinguisher shall be provided per shade/green house.

423.19.7 Fire alarm. Fire alarm pull stations shall be located within 200 feet (60 960 mm) of any shade or green house. Fire alarm horns mounted on a permanent building must be audible inside the shade/green house.

423.19.8 Space heaters. Space heaters, when provided, shall be mounted at least 6 feet 8 inches (2031 mm) AFF.

423.20 Storage.

423.20.1 General storage. Storage rooms and closets shall not be located over or under exit stairs and ramps whether interior or exterior. General storage space(s) shall be included in every educational facility for the bulk storage of materials, supplies, equipment, and books. Storage rooms shall be separated from mechanical and electrical spaces. Storage spaces shall be mechanically ventilated and conditioned as appropriate for the type of materials to be stored. Sinks located in general storage rooms shall not be used for custodial services.

423.20.2 Custodial work areas and storage. Provide custodial work areas with well supported shelving for supplies, cleaning, and sanitation materials and an office area including male/female lockers and toilet facilities.

423.20.3 Custodial closets and storage. Custodial closets shall be provided with storage shelving and a service sink supplied with both hot and cold water. They shall be located to serve each instructional floor and wing regardless of floor area, and other areas such as stage, kitchen, gym, auditorium, clinic, offices and shops. The travel distance to the nearest custodial closet shall not exceed 150 feet.

423.20.4 Chemical and hazardous materials storage. In addition to the requirements of the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal for separation and protection, chemical and hazardous storage facilities shall also include:

423.20.4.1 Chemical storage. Rooms used for the storage, handling, and disposal of chemicals used in school and community college laboratories shall be vented to the exterior. The ventilation system shall not be connected to the air-conditioning return air system, and the rooms shall be kept at moderate temperatures. Doors shall be lockable from the outside and operable at all times from the inside. Rooms shall be well illuminated. Cabinets shall have shelves with a $^1/_2$ inch (12.7 mm) lip on the front and shall be constructed of noncorrosive material. When vented to the exterior, chemical storage cabinets shall be mechanically vented in accordance with NFPA 30 and NFPA 91.

423.20.4.2 Hazardous materials storage. Buildings and/or rooms used for the storage, handling and disposal of flammable, poisonous, or hazardous materials or liquids, and equipment powered by internal combustion engines and their fuels shall be separated from adjacent spaces by 1-hour fire-rated assemblies. These requirements also apply to completely detached buildings within 60 feet (18 288 mm) of student-occupied facilities. Doors shall have a C Label and open directly to the exterior. Storage buildings and/or rooms shall be mechanically ventilated. Electrical fixtures, switches, heat detectors and outlets installed in flammable storage rooms shall be explosionproof.

423.21 Child care/day care/prekindergarten facilities.

423.21.1 Child care/day care/prekindergarten facilities located on board-owned property shall comply with *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal and the specific criteria in this section. Child care/day care/pre-kindergarten facilities requiring a license from another agency may also be required to comply with additional construction requirements imposed by that agency.

423.21.2 Toilet facilities shall meet accessibility requirements and should open into the instructional space. The toilet may be used by both sexes and shall contain a water closet, lavatory and related accessories.

423.21.3 If child care facilities are provided with a bathing area, it shall be within or adjacent to the child care area and shall contain either a shower with hand-held sprayer or a tub. The water temperature shall be controlled by a mixing valve and shall not exceed 110°F (43°C).

423.21.4 Toilet facilities shall have a non-slip impervious floor and 6-foot (1829 mm) impervious wainscot.

423.21.5 Drinking fountain(s) shall be provided for the children and be within close proximity of the child care facility.

423.21.6 A towel and soap dispenser shall be provided at each sink. Hand wash areas for adults shall be provided with warm water; the water temperature shall be controlled by a mixing valve and shall not exceed 110°F (43°C). All electrical receptacles shall be placed out of reach of the children.

423.21.7 When provided, a residential-type kitchen shall include a nonslip floor, a refrigerator, a residential range, a residential-type range hood mechanically exhausted to the outside, and a fire extinguisher located within 15 feet (457 mm) of the range within the same room.

423.21.8 Areas designated for children's sleeping mats, cots or cribs shall include a clearly marked exit passageway.

423.21.9 The child care facility shall not contain any storage of cleaning agents, chemicals, or other hazardous materials in student accessible areas.

423.21.10 Outdoor play areas shall be provided and shall be protected from access to streets or other dangers. The play area shall be fenced or walled to a minimum height of 4 feet (1219 mm) and any latches on maintenance gates shall be secured or beyond the reach of the children.

423.21.11 Shade shall be provided in the play area (a covered play area may be provided).

423.21.12 Play equipment shall be firmly anchored, free of sharp corners or pointed surfaces, and shall have cushioning surfaces such as mats or sand beneath.

423.21.13 The grounds shall be free of undergrowth or harmful plant material.

423.22 Clinics.

423.22.1 Clinics in kindergarten through grade 12 (K-12), vocational-technical centers (VTC), and full service schools shall comply with the general criteria found in the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal, as well as the specific criteria found herein. Clinics shall be located and equipped to provide emergency aid to students. Closets and storage cabinets used for medications and bandages shall have locks, and shall be designed to be under constant supervision.

423.22.2 School clinics shall include locked storage, toilet room and shower, and bed space.

423.22.3 Sanitary facilities are required as follows:

423.22.3.1 Elementary school clinics, including kindergarten, shall include at a minimum one accessible toilet room, to serve male and female students, complete with a water closet, lavatory, accessible shower, changing table, and accessories.

423.22.3.2 Secondary and VTC school clinics shall include two accessible toilet rooms complete with water closet, lavatory, accessories and shower.

423.22.3.3 Toilet rooms in clinics shall include both hot and cold water at the showers and all lavatories. The water temperature shall be controlled by a mixing valve and shall not exceed 110°F (43°C).

423.22.3.4 Toilet rooms shall have exhaust fans vented to the exterior.

423.22.3.5 A working counter top with lavatory/sink and hot water shall be provided in each clinic.

423.22.4 The bed area shall be designed to maintain constant visual supervision from the office. Space for student beds shall be provided in each clinic at 50 square feet (5 m^2) per bed. Space for beds in secondary and VTC schools shall be equally divided for male and female students. Beds shall be provided based on student capacity in the following ratios:

423.22.4.1 Up to 500 students–three beds.

423.22.4.2 501 to 1,000 students–four beds.

423.22.4.3 1,001 to 2,000 students–five beds.

423.22.4.4 Over 2,000–six beds.

423.22.5 Full-service school health clinics.

423.22.5.1 Location. Clinics shall be located to provide a direct accessible route from the exterior and from the interior or by a connecting covered walk.

423.22.5.2 Parking. Clinics shall be provided with 10 designated parking spaces immediately adjacent to the clinic, one of which shall be accessible to persons with disabilities.

423.22.5.3 Sanitary facilities. Sanitary facilities are required as follows:

423.22.5.3.1 Full-service school clinics shall include one accessible toilet room for males and one for females, complete with water closet, lavatory, accessories, and shower. Additional toilets may be required for a full-service school clinic depending on occupant load and program.

423.22.5.3.2 Hot and cold water shall be provided at the showers and lavatories. The water temperature shall be controlled by a mixing valve and shall not exceed 110°F (43°C).

423.22.5.3.3 Toilet rooms shall have exhaust fans vented to the exterior.

423.22.5.3.4 A nurses' station shall be provided with a working counter with lavatory/sink and be located so as to maintain visual supervision of the bed area.

423.22.5.4 Locked storage rooms shall be provided for a refrigerator, files, equipment, and supplies.

423.22.5.5 Data outlets shall be provided for computer hook-ups and computer networking and additional electric outlets shall be provided for hearing and vision testing machines.

423.23 Kilns. Kiln rooms and areas shall be provided with adequate exhaust to dispel emitted heat to the exterior, and they shall not be connected to any other exhaust system. Kilns shall not be located near or adjacent to paths of egress or exit and shall be placed in separate rooms when serving students through grade 3. Kiln rooms shall be provided with appropriate smoke/heat detectors connected to the fire alarm system.

423.24 Open plan schools. An open plan building or portion of a building may be subdivided into smaller areas by use of low partitions [maximum 5 feet high (1524 mm)], movable partitions, or movable furnishing, which by location and type do not hinder or obstruct the ability of persons in one area of the plan to be immediately aware of an emergency condition in any other area of the plan. Corridors shall be identified with different color or type of flooring materials, by permanent low partitions or by other means to prevent blockage of the path of egress to exits by partitions or furniture. When open plan schools are partitioned, the work shall conform to the code requirements for new construction. Demountable or movable partitions in open plan classroom areas shall be a maximum of 5 feet (1524 mm) in height and shall terminate a minimum of 5 feet (1524 mm) from any permanent wall. All circulation openings in open plan areas shall be a minimum of 5 feet (1524 mm) wide. Movable furnishings shall not exceed 5 feet (1524 mm) in height and shall have a stable base.

423.25 Public shelter design criteria.

423.25.1 New facilities. New educational facilities for school boards and community college boards, unless specifically exempted by the board with the written concurrence of the applicable local emergency management agency or the Department of Community Affairs (DCA), shall have appropriate areas designed as enhanced hurricane protection areas (EHPAs) in compliance with this section.

Exception: Facilities located, or proposed to be located, in a Category 1, 2, or 3 evacuation zone shall not be subject to these requirements.

423.25.1.1 Enhanced hurricane protection areas (EHPA). The EHPA areas shall provide emergency shelter and protection for people for a period of up to 8 hours during a hurricane.

423.25.1.1.1 The EHPA criteria apply only to the specific portions of (K-12) and community college educational facilities that are designated as EHPAs.

423.25.1.2 The EHPAs and related spaces shall serve the primary educational or auxiliary use during non-shelter occupancy.

423.25.2 Site. Factors such as low evacuation demand, size, location, accessibility and storm surge may be considered by the board, with written concurrence of the local emergency management agency or the DCA, in exempting a particular facility.

423.25.2.1 Emergency access. EHPAs shall have at least one route for emergency vehicle access. The emergency route shall be above the 100-year floodplain. This requirement may be waived by the board, with concurrence of the local emergency management agency or the DCA.

423.25.2.2 Landscaping. Landscaping around the EHPAs shall be designed to preserve safety and emergency access. Trees shall not conflict with the functioning of overhead or underground utility lines, or cause laydown or impact hazard to the building envelope.

423.25.2.3 Parking. During an emergency condition, vehicle parking shall be prohibited within 50 feet (15 240 mm) of an EHPA. Designated EHPA parking areas may be unpaved.

423.25.2.4 Signage. Floor plans of the facility, indicating EHPAs, shall be mounted in the emergency manager's office/area.

423.25.3 Design. EHPAs may be above or below ground and may have more than one story, provided the design satisfies the wind load and missile impact criteria. Modular and open-plan buildings may serve as EHPAs provided the design satisfies the wind load and missile impact criteria.

423.25.3.1 Excluded spaces. Spaces such as mechanical and electrical rooms, storage rooms, open corridors, kitchens, science rooms and labs, vocational shop areas and labs, computer rooms, attic and crawl spaces shall not be used as EHPAs.

423.25.3.2 Capacity. Fifty percent of the net square feet of a designated educational facility shall be constructed as EHPAs. The net square feet shall be determined by subtracting from the gross square feet those spaces, such as mechanical and electrical rooms, storage rooms, open corridors, kitchens, science rooms and labs, vocational shop areas and labs, computer rooms, attic and crawl spaces that shall not be used as EHPAs. The board, with concurrence of the applicable local emergency management agency or DCA, may adjust this requirement if it is determined to be in its best interest. The capacity of an EHPA shall be calculated at 20 square feet (2 m^2) per occupant (adults and children five years or older).

423.25.3.3 Toilets. Toilet and hand washing facilities should be located within the EHPAs and provided at one toilet and one sink per 40 occupants. These required toilet and hand-washing facilities are not in addition to those required for normal school occupancy and shall be included in the overall facility fixture count.

423.25.3.3.1 Support systems for the toilets, e.g., bladders, portable toilets, water storage tanks, etc., shall be capable of supplying water and containing waste, for the designed capacity of the EHPAs.

423.25.3.3.2 Plumbing and valve systems of "normal" toilets within the EHPAs may be designed for

conversion to emergency operation to meet the required demand.

423.25.3.4 Food service. Where feasible, include counter tops for food distribution functions in the EHPAs.

423.25.3.5 Manager's office. An administration office normally used by a school administrator shall be identified as the EHPA manager's office and shall be located within the EHPA. The office shall have provisions for standby power, lighting, communications, main fire alarm control panel and storage for the manager's equipment.

423.25.4 Structural standard for wind loads. At a minimum, EHPAs shall be designed for wind loads in accordance with ASCE 7, *Minimum Design Loads for Buildings and Other Structures, Category III (Essential Buildings).* Openings shall withstand the impact of wind-borne debris missiles in accordance with the impact and cyclic loading criteria per SBC/SSTD 12. Based on a research document, *Emergency Shelter Design Criteria for Educational Facilities,* by the University of Florida for the DOE, it is highly recommended by the department that the shelter be designed using the map wind speed plus 40 mph, with an importance factor of 1.0.

423.25.4.1 Missile impact criteria. The building enclosure, including walls, roofs, glazed openings, louvers and doors, shall not be perforated or penetrated by a flying object. For walls and roofs, the missile criteria is as provided in SBC/SSTD 12.

423.25.4.1.1 Materials used for walls, roofs, windows, louvers, and doors shall be certified for resistance to missile impact criteria.

423.25.4.1.2 The glazed openings or permanent protective systems over glazed openings shall be designed for cyclic loading.

423.25.4.2 Roofs. Roof decks shall be cast-in-place 4-inch (102 mm) or more, normal weight concrete. Concrete decks shall be waterproof. Systems other than cast-in-place concrete shall have adequate bearing, anchorage against wind uplift, diaphragm action, and resistance to rain that are equivalent to a cast-in-place system.

Exception: Structural precast concrete roofs, composite metal decks with normal weight concrete roofs, or other systems and materials that meet the wind load and missile impact criteria may be used.

423.25.4.2.1 Light weight concrete or insulating concrete may be used on roof decks of EHPAs provided the roof decks are at least 4-inch (102 mm) cast-in-place normal weight concrete or other structural systems of equivalent strength.

423.25.4.2.2 Roof openings (e.g., HVAC fans, ducts, skylights) shall be designed to meet the wind load and missile impact criteria.

423.25.4.2.3 Roof coverings shall be specified and designed according to the latest ASTM and Factory Mutual Standards for materials and wind uplift forces. Roofs shall be inspected by a licensed engineer/architect and a representative of the roofing manufacturer.

423.25.4.2.4 Roofs shall have adequate slope and drains sized for normal use and shall have emergency overflow scuppers which will accommodate a 2-inch-per-hour (51 mm) rain for 6 hours.

423.25.4.2.5 Parapets shall satisfy the wind load and missile impact criteria; roof overhangs shall resist uplift forces.

423.25.4.3 Windows. All unprotected window assemblies and their anchoring systems shall be designed and installed to meet the wind load and missile impact criteria.

423.25.4.3.1 Windows may be provided with permanent protective systems, provided the protective system is designed and installed to meet the wind load and missile impact criteria and completely covers the window assembly and anchoring system.

423.25.4.3.2 EHPAs shall have mechanical ventilation systems. Ventilation shall be provided at a minimum rate of 2 cfm per square foot of EHPA floor area. The mechanical ventilation system shall be connected to the EHPA's emergency power.

423.25.4.4 Doors. All exterior and interior doors subject to possible wind exposure and/or missile impact shall have doors, frames, anchoring devices, and vision panels designed and installed to resist the wind load and missile impact criteria or such doors, frames, anchoring devices, and vision panels shall be covered with permanent protective systems designed and installed to resist the wind load and missile impact criteria.

423.25.4.5 Exterior envelope. The exterior envelope, louvers over air intakes and vents, and gooseneck type intakes and vents of EHPAs shall be designed and installed to meet the wind load and missile impact criteria.

423.25.4.5.1 HVAC equipment mounted on roofs and anchoring systems shall be designed and installed to meet the wind load criteria.

423.25.4.5.2 Roof mounted HVAC equipment shall have a 12-inch-high (305 mm) curb around the roof opening and be designed to prevent the entry of rain water.

423.25.4.6 Foundations and floor slabs. Foundations shall be designed to resist all appropriate loads and load combinations, including overturning moments due to wind. The floor elevation and necessary life safety and other emergency support systems of EHPAs shall be elevated above the maximum storm surge inundation elevation associated with a Category 4 hurricane event. Storm surge elevations shall be identified by the most current edition of the regional Sea Lake and Overland Surges from Hurricanes (SLOSH) studies and atlases.

423.25.5 Electrical and standby emergency power system. The EHPA shall be provided with a standby emergency electrical power system, per Chapter 27, NFPA 70 Articles 700 and 701, which shall have the capability of being connected to a backup generator or other optional power source. Where economically feasible, an equivalent photovoltaic system may be provided. The EHPA's emergency systems

includes, but are not limited to: (1) an emergency lighting system, (2) illuminated exit signs, (3) fire protection system(s), alarm (campus wide) and sprinkler, and (4) minimum ventilation for health/safety purposes. The fire alarm panel shall be located in the EHPA manager's office. A remote annunciator panel shall be located in or adjacent to the school administrator's office. When generators are installed, the facility housing the generator, permanent or portable, shall be an enclosed area designed to protect the generators from wind and missile impact. Air intakes and exhausts shall be designed and installed to meet the wind load and missile impact criteria. Generators hardened by the manufacturer to withstand the area's design wind and missile impact criteria shall be exempt from the enclosed area criteria requirement.

423.25.5.1 EHPA lighting. Emergency lighting shall be provided within the EHPA area, EHPA manager's office, toilet rooms, main electrical room and generator spaces and shall be at least 10 footcandles (100 lux) of general illumination, which can be reduced to $^1/_2$ footcandle (5 lux) in the sleeping areas during the night.

423.25.5.2 Optional standby circuits. Additional nonlife safety systems, as defined by Chapter 27, NFPA 70 Article 702 (optional standby circuits), may be supplied power, if available, by the Standby Emergency Power System. These systems shall be connected to the Standby Emergency Power System via an electrical subpanel to the Standby Electrical Power System's main electrical panel. This will allow selective or total load shedding of power if required. The fire alarm, emergency lighting and illuminated exit signs throughout the entire campus shall receive first priority to power provided by the Standby Emergency Power System per Chapter 27, NFPA 70 Article 700. The systems listed are not all encompassing but are in order of priority. Local officials may request additional non-life safety systems they deem necessary for health, welfare and safety of the public during occupancy:

1. Remainder of the school's campus security lighting (building and site).
2. Additional ventilation systems within the EHPA, including heat.
3. Intercom system.
4. Food storage equipment.
5. Additional electric receptacles, other than those required by Section 423.25.5.3.

423.25.5.3 Receptacle outlets. A minimum of four electrical outlets, served with power from the standby circuits, shall be provided in the EHPA manager's office.

423.25.6 Inspections. EHPAs shall be considered "threshold buildings" in accordance with Section 553.71(7), *Florida Statutes*, and shall comply with Sections 553.79(5), 553.79(7), and 553.79(8), *Florida Statutes*.

423.25.6.1 Construction of EHPAs shall be inspected during the construction process by certified building code inspectors or the design architect/engineer(s) certified pursuant to Part XII Chapter 468, *Florida Statutes* and threshold inspectors for compliance with applicable rules and laws.

423.25.6.2 The emergency electrical systems shall be inspected during the construction process by certified electrical inspector or Florida-registered professional engineers certified pursuant to Part XII Chapter 468, *Florida Statutes*, skilled in electrical design.

423.25.6.3 EHPAs shall be inspected and recertified for compliance with the structural requirements of this section every five years by a Florida-registered professional engineer skilled in structural design. If any structural system, as specified in this section, is damaged or replaced, the recertification shall be obtained prior to the beginning of the next hurricane season.

423.25.6.4 All shutter systems, roofs, overflow scuppers, and structural systems of EHPAs shall be inspected and maintained annually prior to hurricane season and after a major event. All emergency generators shall be inspected under load conditions including activation of the fire alarms, emergency lights as per applicable equipment codes and NFPA standards, and including mechanical systems and receptacles connected to the emergency power.

423.26 Time-out rooms.

423.26.1 Locking an individual inside a space without a means of opening the door from within that space is contrary to the exiting philosophy of the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal for educational facilities. The educational program which requires containment of the out-of-control student can be accommodated within this context only if the following are met:

423.26.2 Electromagnetic locking device. When a time-out room is to be locked, an electromagnetic locking device may be used and shall have the following features:

423.26.2.1 The lock shall remain engaged only when a push button mounted outside the time-out room adjacent to the door frame, or other hand held device, is continuously depressed by hand. Upon release of pressure, the door shall unlock. The locking device shall be designed so that it cannot be engaged by leverage of an inanimate object or in any other manner except by constant human contact.

423.26.2.2 The push button, or similar device, shall be recessed from the face of the unit housing, or in some other way designed to prevent taping or wedging the button in the engaged mode.

423.26.2.3 The device shall have an interface relay with the fire alarm system and shall automatically release upon activation of the fire alarm.

423.26.2.4 The locking device shall automatically disengage in the event of a power failure.

423.26.2.5 Timers shall not be used on the locking device.

423.26.3 Door requirements. The door shall have only a push plate exposed on the interior of the room.

423.26.3.1 The door shall swing out of the room and shall be equipped with a fully concealed track type closer.

423.26.3.2 A vision panel shall be provided in the door, and it shall be no larger than 144 square inches (.1 m^2). The view panel shall consist of a clear $^1/_4$-inch-thick (6 mm) unbreakable plastic panel flush with the inside face of the door on the inside of the room. The panel shall be positioned in the door so that a staff member may continuously keep the student under surveillance.

423.26.3.3 The door frame and jamb/head reveal on the inside shall be minimal. If provided, a flat metal threshold shall be used.

423.26.4 Finishes. The floor and walls shall be durable, vandal-resistant materials. The ceiling shall be of a solid and moisture-resistant material. There shall be no projections or protrusions from the walls, ceiling, or floor. All surfaces shall be smooth and no electrical outlets, switches, plumbing clean-outs or similar items shall be inside the room. The room shall not contain anything that can be set on fire, torn, shredded or otherwise used for self-harm.

423.26.5 Minimum size. The room shall be designed for a single occupant only and shall be a minimum of 6 feet by 6 feet (1828 mm by 1828 mm).

423.26.6 Lighting. The room shall have a recessed vandalproof light fixture in the ceiling capable of being dimmed. The light switch shall be located outside the room adjacent to the door jamb.

423.26.7 HVAC required. Time-out rooms shall be mechanically heated and cooled. Registers shall be ceiling mounted and vandalproof.

423.27 New relocatable buildings.

423.27.1 Relocatables. The terms "relocatable" and "portable" are interchangeable and both terms are used to describe buildings which are constructed to the same building codes as permanent public school buildings, except they are designed to be moved. These buildings may be manufactured in a plant, constructed on site, may be made of demountable components, and may be combined. All new relocatable or portable classrooms shall be designed and constructed in compliance with the *Florida Building Code*, the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal and the Department of Community Affairs rules for factory-built school buildings (see Section 428). The requirements for new relocatables contained herein are in addition to the minimum requirements of the *Florida Building Code* and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal. New relocatables which do not comply with the building codes, fire codes and these standards shall not be used as classrooms or for any other student occupancy. For code requirements and other standards applicable to relocatables constructed prior to this code, which may be Type V (wood) relocatables, see *Existing Relocatables, Volume 1, Section 5(2), State Requirements for Educational Facilities* as referenced in the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal.

423.27.1.1 Factory-built school shelter means any site-assembled or factory-built school building that is designed to be portable, relocatable, demountable or reconstructable and that complies with the provisions for enhanced hurricane protection areas, as required by the applicable code (see Section 423.25).

423.27.2 Design, plan approval, construction. Regardless of cost or fund source, whether used for classroom, auxiliary or ancillary space, whether leased, purchased, contracted, or constructed by the school board or community college board, plans and documents for relocatables, portables and modular schools shall be prepared by Florida registered design professionals and submitted to the authority having jurisdiction for review and approval for compliance with Florida laws, rules, building and life safety codes. The buildings shall be constructed and inspected by personnel licensed, certified or trained as required by Florida construction industry licensing laws.

423.27.2.1 District-wide foundation plans. District-wide foundation plans for tie down and wind resistance for each type of relocatable and each type of known soil condition in the district, shall be prepared and reviewed at the time of the design and shall be required as a part of the approval of any relocatable. These documents shall be kept on file in the district, with an additional copy in each relocatable filed together with current annual local fire inspection reports, as required by law. The foundation plans shall be reviewed and updated when necessary for compliance with current code for subsequent installations of the relocatable. Relocatables which do not meet the requirements of code for tie down and wind resistance shall not be occupied.

423.27.2.2 DOT Requirements. Relocatable units designed to be moved on state roads shall comply with the maximum unit height, length and width requirements of the DOT.

423.27.2.3 Inventory/construction date signage. A FISH inventory room number and the date of construction shall be noted on an inventory sign permanently affixed outside, beside or above the door, on all relocatables owned or leased by a district.

423.27.3 Construction type. All new relocatables constructed, purchased or otherwise acquired by a board shall be noncombustible Type I, II or IV construction.

423.27.4 Accessibility. All relocatables constructed, purchased or otherwise acquired by a board after the effective date of these standards shall comply with the Americans with Disabilities Act as modified by Chapter 553, *Florida Statutes*, Chapter 11 of the *Florida Building Code, Building*. Relocatables intended for use at facilities housing up to grades 5 or 6, shall also conform to the federal criteria *Accessibility Standards for Children's Environments,* which is available from the U.S. Architectural and Transportation Barriers Compliance Board.

423.27.5 Site standards/site plan. Relocatables placed on educational plant sites shall comply with federal and state laws and rules relating to the placement of structures on sites, as well as building code, fire code site requirements.

423.27.5.1 Floodplain. Compliance with floodplain standards is required for the initial and subsequent installation of public educational relocatable units. The finished floor shall be 12 inches (305 mm) above base flood elevation, the structure shall be designed to meet the *Florida Building Code* and anchored to resist buoyant forces.

423.27.5.2 Covered walks and technology. New relocatables and "modular schools" acquired by a board which are intended for long term use, shall be connected from exit door to the core facilities by accessible covered walkways, and shall contain wiring and computer technologies which connect to the facility's technology, communications and fire alarms infrastructure.

Exceptions:

1. Covered walks and public address systems are not required in community college facilities.
2. Temporary relocatables constructed after the date of this standard shall meet all construction requirements of this code, except that covered walks may be installed. The term "temporary relocatable" means relocatables which are used for less than three years to provide temporary housing while permanent replacement classrooms and related facilities are under construction, renovation or remodeling. The term "temporary relocatable" does not apply to relocatables which have been located on a school site for more than two years and used for classrooms or for student occupancy, where there is no identifiable permanent facility which is under construction, being remodeled, or renovated to house the students.

423.27.5.3 Separation of units. Type I, II or IV, (noncombustible) relocatable units shall be separated as required by the *Florida Building Code* and the school site plan.

423.27.6 Structure. Relocatable structures shall be positively anchored and designed to comply with *Florida Building Code* requirements.

423.27.7 Fire-retardant-treated wood (FRTW). Only FRTW which does not contain ammonium phosphates, sulfates, or halides may be used in the roof structure of Type II construction, as authorized by other sections of the *Florida Building Code*. FRTW shall comply with the specific requirements found elsewhere in these public educational facilities requirements. Contractors shall provide evidence of compliance to inspectors. Inspection access panels shall be provided to facilitate initial and annual inspections for general condition assessment of FRTW and connectors.

423.27.8 Doors. Exit doors shall swing in the direction of exit travel.

423.27.8.1 Classroom locksets. Each door shall be equipped with a lockset, which is readily opened from the side from which egress is to be made at all times, a threshold, heavy duty hinges, and closer to control door closing. Each door shall have a view panel, with minimum dimensions of 8 inches by 42 inches (1067 mm) and a maximum of 1,296 square inches (.84 m^2), of ¼ inch (6 mm) tempered or safety glass installed with the bottom edge of the panel at 30 inches (762 mm) AFF. Each exterior door shall be protected from the elements by a roof overhang.

423.27.8.2 Roofed platform. All exterior doors shall open onto a minimum 5 foot by 5 foot (1524 mm by 1524 mm) roofed platform with handrails, which is level with the interior floor.

423.27.9 Operable windows. Classrooms shall have operable windows equal to at least 5 percent of the floor area of the unit where required by Section 1013.44, *Florida Statutes*. Exterior doors may be included in computing the required 5 percent. Awning, casement, or projecting windows shall not be placed in walls with adjacent walks, ramps, steps or platforms.

423.27.9.1 Rescue. Windows for emergency rescue shall comply with NFPA 101, Florida edition as adopted by the *Florida Fire Prevention Code*, shall be operable from the inside by a single operation and shall be labeled "EMERGENCY RESCUE–KEEP AREA CLEAR."

423.27.10 Finishes. Finishes in relocatable units shall comply with the following:

423.27.10.1 Interior walls and ceilings. Interior wall and ceiling finishes in classrooms and other student use spaces shall be Class A or B as defined in NFPA 101, Florida edition as adopted by the *Florida Fire Prevention Code*. Corridor finishes shall be Class A. Formaldehyde levels shall not exceed the minimum HUD standards for manufactured housing.

423.27.10.2 Floors. Floors shall be covered with resilient material, carpet, or other finished product. Carpet in classrooms shall be tested and certified by the manufacturer as passing the Radiant Panel Test Class II. Carpet in corridors shall be tested and certified by the manufacturer as passing the Radiant Panel Test Class I.

423.27.10.3 Toilet rooms, showers and bathing facilities. Partitions and walls separating group toilet rooms shall be extended to the bottom of the roof deck.

423.27.10.3.1 Toilet room floors and base shall be finished with impervious nonslip materials. Toilet room walls shall be finished with impervious materials which shall be extended to a minimum height of 6 feet (1828 mm).

423.27.10.3.2 Ceilings shall be of solid-type moisture- resistant materials.

423.27.11 Fire extinguishers. At least one appropriate fire extinguisher shall be provided in each relocatable classroom unit and in each classroom of a multiclassroom building.

423.27.12 Document storage. Provision shall be made to secure foundation plans and to post the annual fire inspection report within each relocatable unit.

423.27.13 Time-out rooms. Time-out rooms are not recommended but, when provided, shall comply with the specific requirements for time-out rooms found elsewhere in these public educational facilities code requirements.

423.27.14 Child care/day care units. Standard classroom units intended to house birth to age 3 children, including Teenage Parent Programs (TAP), shall meet the additional criteria under the title of *Child Care/Day Care/ Prekindergarten Facilities* for permanent buildings contained in these public educational facilities requirements, as well as the following:

423.27.14.1 All TAP spaces where residential kitchens are provided shall have two doors exiting directly to the outside and remotely located from each other. Areas designated for children's sleeping mats, cots or cribs, shall have a clearly marked exit passageway.

423.27.15 Illumination required. Illumination in classroom units shall be designed to provide an average maintained 50 footcandles (500 lux) at desk top.

423.27.15.1 Emergency lighting. Each classroom unit shall be equipped with emergency lighting.

423.27.15.2 Exterior lighting. Exterior lighting shall be provided as required elsewhere in these public educational facilities code requirements.

423.27.15.3 Exit lighting. Exit lights shall be provided as required by the *Uniform Fire Safety Standards* adopted by the State Fire Marshal.

423.27.16 Air conditioning, heating and ventilation. Relocatable facilities shall meet *Florida Building Code* requirements.

423.27.17 Technology. Relocatables shall contain wiring and computer technology appropriate for the programs to be housed.

423.27.18 Fire safety requirements. New relocatables shall be provided with fire alarm devices meeting the code requirements for permanent educational facilities and shall be connected to the facility's main fire alarm system as required by code.

423.27.19 Inspection of units during construction. Boards shall provide for the inspection of relocatables during construction, as required by the *Florida Building Code*, as authorized by statute.

423.27.20 Inspection of units prior to occupancy. Prior to occupancy new relocatables shall be inspected and approved for compliance to the *Florida Building Code*. New units shall have foundation plans provided and secured, in the relocatable along with the local fire inspector report. Certification of such inspection shall remain on file with the district. Inventory/date of construction signage shall be affixed to the relocatable. Where FRTW is used inspection access panels shall be provided and within easy reach to facilitate inspection for general condition assessment of FRTW and connectors.

SECTION 424
SWIMMING POOLS AND BATHING PLACES (PUBLIC AND PRIVATE)

424.1 Public swimming pools and bathing places. Public swimming pools and bathing places shall comply with the design and construction standards of this section.

NOTE: Other administrative and programmatic provisions may apply. See Department of Health (DOH) Rule 64E-9, *Florida Administrative Code* and Chapter 514, *Florida Statutes*.

"Bathing load" means the maximum number of persons allowed in the pool at one time.

"Collector tank" means a reservoir, open to the atmosphere, from which the recirculation pump takes suction, which may receive the gravity flow from the main drain line and surface overflow system.

"Interactive water features" means a structure designed to allow for recreational activities with recirculated, filtered, and treated water; but having minimal standing water. Water from the interactive fountain type features is collected by gravity below grade in a collector tank or sump. The water is filtered, disinfected and then pumped to the feature spray discharge heads.

"Perimeter overflow gutter" means a level trough or ledge around the inside perimeter of the pool containing drains to clean the pool water surface.

"Plunge pool" means the receiving body of water located at the terminus of a recreational water slide.

"Pool floor" means the interior pool bottom surface which consists of that area from a horizontal plane up to a maximum of a 45-degree slope.

"Pool wall" means the interior pool side surfaces which consist of that area from a vertical plane to a 45-degree slope.

"Precoat pot" means a container with a valved connection to the suction side of the recirculation pump of a pressure diatomaceous earth (D.E.) filter system used for coating the filter with D. E. powder.

A **"public swimming pool"** or **"public pool"** means a watertight structure of concrete, masonry, or other approved materials which is located either indoors or outdoors, used for bathing or swimming by humans, and filled with a filtered and disinfected water supply, together with buildings, appurtenances, and equipment used in connection therewith. A public swimming pool or public pool shall mean a conventional pool, spa-type pool, wading pool, special purpose pool, or water recreation attraction, to which admission may be gained with or without payment of a fee and includes, but is not limited to, pools operated by or serving camps, churches, cities, counties, day care centers, group home facilities for eight or more clients, health spas, institutions, parks, state agencies, schools, subdivisions, or the cooperative living-type projects of five or more living units, such as apartments, boardinghouses, hotels, mobile home parks, motels, recreational vehicle parks, and townhouses. The term does not include a swimming pool located on the grounds of a private residence.

"Recirculation system" means the system of piping and mechanics designed to remove the water from the pool then filter, disinfect and return it to the pool.

"Slip resistant" means having a textured surface which is not conducive to slipping under contact of bare feet unlike glazed tile or masonry terrazzo and nontextured plastic materials. manufactured surface products shall be designated by the manufacturer as suitable for walking surfaces in wet areas.

"Spa pool" means a pool used in conjunction with high-velocity air or water.

"Special purpose pool" means a public pool used exclusively for a specific, supervised purpose, including springboard or platform diving training, SCUBA diving instruction, and aquatic programs for persons with disabilities, preschool or kindergarten children.

"Wading pool" means a shallow pool designed to be used by children.

"Water recreation attraction" means a facility with design and operational features that provide patron recreational activity and purposefully involves immersion of the body partially or totally in the water. Water recreation attractions include water slides, lazy river rides, water course rides, water activity pools, and wave pools.

"Lazy river ride" means a water recreation attraction designed to convey bathers around a relatively flat course using an artificially created current.

"Wade pool" means a water recreation attraction ride which is characterized by having trough-like or tubular flumes or chutes.

"Wet deck area" means the 4-foot-wide (1219 mm) unobstructed pool deck area around the outside of the pool water perimeter, curb, ladders, handrails, diving boards, diving towers, or pool slides.

"Zero depth entry pool" means a pool where the pool floor continues to slope upward to a point where it meets the surface of the water and the pool deck.

424.1.1 Sizing. The bathing load for conventional swimming pools and special purpose pools shall be computed on the basis of one person per 5 gpm (.32 L/s) of recirculation flow. The bathing load for wading pools and interactive water features shall be established by averaging one person per 10 square feet (.9 m^2) of pool area and one person per 5 gpm (.32 L/s) of filter rate. The bathing load for spa type pools shall be based on one person per each 10 square feet (.9 m^2) of surface area. The filtration system shall be capable of meeting all other requirements of these rules while providing a flowrate of at least 1 gpm (.06 L/s) for each living unit at transient facilities and $^3/_4$ gpm (.04 L/s) at nontransient facilities. All other types of projects shall be sized according to the anticipated bathing load and proposed uses. For the purpose of determining minimum pool size only, the pool turnover period used cannot be less than 3 hours.

424.1.2 Swimming pool construction standards.

424.1.2.1 Pool structure. Pools shall be constructed of concrete or other impervious and structurally rigid material. All pools shall be watertight, free from structural cracks and shall have a nontoxic smooth and slip-resistant finish. Tile used in less than 5 feet (1524 mm) of water must be slip resistant except for bull-nose tile when utilized as step, bench or swimout markings.

424.1.2.2 Dimensions.

424.1.2.2.1 Dimensional standards. Dimensional standards for competition type pools shall be those published by the National Collegiate Athletic Association, 1990; Federation Internationale de Natation Amateur (FINA), 1998-2000 Handbook; 1998-1999 Official Rules of Diving & Code Regulation of United States Diving Inc.; 1998 United States Swimming Rules and Regulations, and National Federation of State High School Associations, 1997-1998, which are incorporated by reference in this code.

424.1.2.2.2 Walls and corners. All pool walls shall have a clearance of 15 feet (4572 mm) perpendicular to the wall. Offset steps and spa coves are exempt from this clearance requirement. The upper part of pool walls in areas 5 feet deep or less shall be within 5 degrees (4572 mm) vertical for a minimum depth of 2½ feet (762 mm) from which point the wall may join the floor with a maximum radius equal to the difference between the pool depth and 2½ feet. The upper part of pool walls in areas over 5 feet deep shall be within 5 degrees vertical for a minimum depth equal to the pool water depth minus 2½ feet (762 mm) from which point the wall may join the floor with a maximum radius of 2½ feet (762 mm). Corners shall be a minimum 90-degree angle. The corner intersections of walls which protrude or angle into the pool water area shall be rounded with a minimum radius of 2 inches (51 mm).

424.1.2.2.3 Pool floor slope and slope transition. The radius of curvature between the floor and walls is excluded from these requirements. multiple floor levels in pools are prohibited.

424.1.2.2.3.1 Floor slope shall be uniform. The floor slope shall be a maximum 1 unit vertical in 10 units horizontal and a minimum of 1 unit vertical in 40 units horizontal in areas 5 feet (1524 mm) deep or less. The floor slope shall be a maximum 1 unit vertical in 3 units horizontal in areas more than 5 feet (1524 mm) deep.

424.1.2.2.3.2 Any transition in floor slope shall occur at a minimum of 5 feet (1524 mm) of water depth. A slope transition shall have a 2-inch-wide (51 mm) dark contrasting marking across the bottom and must extend up both sides of the pool at the transition point. A slope transition shall have a safety line mounted by use of cup anchors, 2 feet (610 mm) before the contrasting marking, toward the shallow end. The safety line shall have visible floats at maximum 7-foot (2134 mm) intervals.

424.1.2.2.4 Pool depths. The minimum water depth shall be 3 feet (914 mm) in shallow areas and 4 feet (1219 mm) in deep areas.

424.1.2.3 Markings.

424.1.2.3.1 Depth markings. Depth markings shall meet the following criteria:

1. Permanent depth markings followed by the appropriate full or abbreviated words "FEET" or "INCHES" shall be installed in minimum 4-inch-high (102 mm) numbers and letters on a contrasting background. Depth markers shall indicate the actual pool depth, within 3 inches (76 mm), at normal operating water level when measured 3 feet (914 m^3) from the pool wall. Symmetrical pool designs with the deep point at the center may be allowed provided a dual marking system is used which indicates the depth at the wall and at the deep point.
2. The markings shall be located on both sides of the pool at the shallow end, slope break, deep end wall and deep point (if located more than five feet from the deep end wall) with a maximum perimeter distance between depth markings of 25 feet (7620 mm)and shall be legible from inside the pool and also from the pool deck.
3. When a curb is provided, the depth markings shall be installed on the inside and outside or top of the pool curb. When a pool curb is not provided, the depth markings shall be located on the inside vertical wall at or above the water level and on the edge of the deck within two feet of the pool water. When open type gutter designs are utilized, depth markers shall be located on the back of the gutter wall.
4. When deck level perimeter overflow systems are utilized, additional depth markers shall be placed on adjacent fencing or walls and the size shall be increased so they are recognizable from inside the swimming pool. Depth markers on the pool deck shall be within three feet of the water.
5. Those areas of the pool that are not part of an approved diving bowl shall have dark contrasting, permanent, 4-inch-high (102 mm) "NO DIVING" markings installed on the top of the pool curb or deck within 2 feet (610 mm)of the pool water on each side of the pool with a maximum distance of 25 feet (7620 mm) between markings. A 6-inch (152 mm) tile with a 4-inch (102 mm) or larger red, international "NO DIVING" symbol may be substituted for the "NO DIVING" markings.
6. All depth markings shall be tile, except that pools constructed of fiberglass, thermoplastic or stainless steel may substitute other type markings when it can be shown that said markings are permanent and will not fade over time. This exemption does not extend to concrete pools that are coated with fiberglass. All depth and "NO DIVING" markings installed on horizontal surfaces shall have a slip-resistant finish.

424.1.2.3.2 Designs or logos. Any design or logo on the pool floor or walls shall be such that it will not hinder the detection of a human in distress, algae, sediment, or other objects in the pool.

424.1.2.3.3 Lane markings. Pools that are not intended to be utilized for officially sanctioned competition may install lap lane markings provided they meet the following criteria: the markings must be 4 inches (102 mm) wide, they must terminate 5 feet (1524 mm) from the end wall in a "T" with the "T" bar at least 18 inches (1524 mm) long, they must be placed at 7-foot (2134 mm) intervals on center and be no closer than 4 feet (1219 mm) from any side wall, steps or other obstructions.

424.1.2.3.4 Targets. Pools that are not intended for officially sanctioned competition may have up to 4-inch (102 mm) wide 18-inch by 18-inch (457 mm by 457 mm) targets (+) installed on the pool wall.

424.1.2.4 Color. Pool floors and walls shall be white or light pastel in color and shall have the characteristic of reflecting rather than absorbing light.

Exception: A dark color may be used if (1) a tile line [minimum 4 inches (102 mm), maximum 12 inches (305 mm)] is installed at the water line or (2) if 2-inch (51 mm) tile is installed along the pool wall edge of the gutter lip for gutter type pools.

424.1.2.5 Access. All pools shall have a means of access every 75 feet (22 860 mm) of pool perimeter with a minimum of two, located so as to serve both ends of the pool. When the deep portion of the pool is over 30 feet (9144 mm) wide both sides of this area shall have a means of access. Access shall consist of ladders, stairs, recessed treads or swimouts and may be used in combination. All treads shall have a slip-resistant surface.

424.1.2.5.1 Ladders. Ladders shall be of the cross-braced type and shall be constructed of corrosion-resistant materials and be securely anchored into the pool deck. Clearance between the ladder and pool wall shall be between 3 to 6 inches (76 mm to 152 mm). Ladders shall extend at least 28 inches (711 mm) above the pool deck.

424.1.2.5.2 Recessed treads. Recessed treads shall be installed flush with the wall and shall be a minimum five inches wide, 10 inches (254 mm) long, with a maximum vertical distance of 12 inches (305 mm) between treads.

424.1.2.5.3 Stairs. Stairs shall have a minimum tread width of 10 inches (254 mm) for a minimum tread length of 24 inches (610 mm) and a maximum riser height of 10 inches (254 mm) . Treads and risers between the top and bottom treads shall be uniform in width and height. The front $^3/_4$ to 2 inches (19.1 to 51 mm) of the tread and the top 2 inches (51mm) of the riser shall be tile, dark in color, contrasting with the interior of the pool. Tile shall be slip resistant, except when $^3/_4$ inch by 2-inch (51 mm) bull-nose tile is used and the $^3/_4$ inch (19 mm) segment is placed on the

tread and the 2-inch (51 mm) segment is on the riser. All markings shall be tile, except that pools constructed of fiberglass, thermoplastic or stainless steel may substitute other type markings when it can be shown that said markings are permanent and will not fade over time. This exception does not extend to concrete pools that are coated with fiberglass.

424.1.2.5.4 Swimouts. Swimouts shall extend 18 to 24 inches (610 mm) back from the pool wall, shall be 4 to 5 feet (1219 mm to 1524 mm) wide, shall be a maximum of 12 inches (305 mm) below the deck, unless stairs are provided in the swimout, and shall be located only in areas of the pool greater than 5 feet (1524 mm) deep. Pools that do not utilize a continuous perimeter overflow system must provide a wall return inlet in the swimout for circulation. A permanent dark contrasting colored band of tile shall be installed at the intersection of the pool wall and the swimout and must extend 2 inches (51 mm) on the horizontal and vertical surfaces. Tile must be slip resistant, except that bull-nose tile may be substituted and installed in accordance with Section 424.1.2.5.3 above.

424.1.2.5.5 Handrails and grabrails. Handrails shall be provided for all stairs, shall be anchored in the bottom step and the deck. Where "figure 4" deck-mounted type handrails are used, they shall be anchored in the deck and extend laterally to any point vertically above the bottom step. A grabrail shall be provided for all swimouts and shall not protrude more than 6 inches (152 mm) over the water surface. Grabrails must be mounted in the pool deck at each side of recessed steps. Handrails and grabrails shall extend at least 28 inches (28 mm) above the step edge and deck.

424.1.2.5.6 Disabled access. Permanent or portable steps, ramps, handrails, lifts or other devices designed to accommodate persons with disabilities in swimming pools may be provided. Lifts mounted into the pool deck shall have a minimum 4-foot-wide (1219 mm) deck behind the lift mount.

424.1.2.6 Obstructions. The pool water area shall be unobstructed by any type structure unless justified by engineering design as a part of the recirculation system. Engineering design and material specifications shall show that such structures will not endanger the pool patron, can be maintained in a sanitary condition and will not create a problem for sanitary maintenance of any part of the pool, pool water, or pool facilities. Structures in accord with the above shall not be located in a diving bowl area or within 15 feet (4572 mm) of any pool wall.

Exceptions:

1. Stairs, ladders and ramps, necessary for entrance/exit from the pool are not considered obstructions.
2. Underwater seat benches may be installed in areas less than 5 feet (1524 mm) deep. Bench seats must be 14 to 18 inches (356 to 457 mm) wide and must have a dark contrasting marking on the seat edge extending 2 inches (51 mm) on the horizontal and vertical surface. If tile is used it must be slip resistant, except that bullnose tile may be substituted and installed in accordance with Section 424.1.2.5.3.

424.1.2.7 Diving areas. Diving facilities shall meet the minimum requirements of the FINA dimensions for diving facilities in accordance with the 1998-2000 FINA Handbook and include the following:

1. Diving boards or platforms with heights of less than the established standard shall meet the dimensional requirements of the next greater height.
2. Diving boards, platforms and ladders shall have a nonabsorbent, slip-resistant finish and be of sufficient strength to safely carry the anticipated loads. Diving equipment one meter and greater shall have guard rails which are at least 36 inches (914 mm) above the diving board and extend to the edge of the pool wall. All diving boards over 21 inches (533 mm) from the deck shall be provided with a ladder. Diving boards or platforms shall not be installed on curved walls where the wall enters into the defined rectangular diving area specified in this section. Adjacent platform and diving boards shall be parallel.
3. The location of pool ladders shall be such that the distance from the ladder to any point on a diving board or platform centerline is not less than the plummet to side wall dimension (b) indicated in the FINA standards. Trampoline-type diving facilities are prohibited.
4. Diving targets may be installed in accordance with FINA standards.

424.1.3 Pool appurtenances.

424.1.3.1 Decks and walkways.

424.1.3.1.1 Pool wet decks shall be constructed of concrete or other nonabsorbent material having a smooth slip-resistant finish. Wet deck area finishes shall be designed for such use and shall be installed in accordance with the manufacturer's specifications. Wooden decks and walkways are prohibited.

424.1.3.1.2 Pool wet decks shall be uniformly sloped at a minimum of 2 percent to a maximum of 4 percent away from the pool or to deck drains to prevent standing water. When a curb is provided, the deck shall not be more than 10 inches (254 mm) below the top of the curb.

424.1.3.1.3 Pool wet decks shall have a minimum unobstructed width of 4 feet (1219 mm) around the perimeter of the pool, pool curb, ladders, handrails, diving boards, diving towers and slides.

424.1.3.1.4 Traffic barriers shall be provided as needed so that parked vehicles do not extend over the deck area.

424.1.3.1.5 Walkways shall be provided between the pool and the sanitary facilities, and shall be con-

structed of concrete or other nonabsorbent material having a smooth slip-resistant finish for the first 15 feet (4572 mm) of the walkway measured from the nearest pool water's edge. A hose bibb with a vacuum breaker shall be provided to allow the deck to be washed down with potable water.

424.1.3.1.6 Ten percent of the deck along the pool perimeter may be obstructed. Obstructions shall have a wet deck area behind or through them, with the near edge of the walk within 15 feet (4572 mm) of the water. These obstructions shall be protected by a barrier or shall be designed to discourage patron access. When an obstruction exists in multiple areas around the pool the minimum distance between obstructions shall be 4 feet (1219 mm) .

424.1.3.1.7 Food or drink service facilities shall not be located within 12 feet (3658 mm) of the water's edge.

424.1.3.1.8 The vertical clearance above the pool deck shall be at least 7 feet (2137 mm).

424.1.3.1.9 All public pools shall be surrounded by a minimum 48 inch (1219 mm) in height fence. The fence shall be continuous around the perimeter of the pool area that is not otherwise blocked or obstructed by adjacent buildings or structures and shall adjoin with itself or abut to the adjacent members. Access through the barrier other than from doored exits of adjacent building(s) shall be through self-closing, self-latching lockable gates of 48 inch (1219 mm) minimal height with the latch located near the top. Consideration shall be given to the U.S. Consumer Product Safety Commission (CPSC) Pub. No. 362 guidelines. Safety covers that comply with ASTM F 1346 do not satisfy this requirement.

424.1.3.2 Bridges and overhead obstructions. Bridges and overhead obstructions over the pool shall be designed so they will not introduce any contamination to the pool water. The minimum height of the bridge or obstruction shall be at least 8 feet (2438 mm) from the bottom of the pool and at least 4 feet (1219 mm) above the surface of the pool. Minimum 42-inch-high (1067 mm) handrails shall be provided along each side of the bridge. The walking surfaces shall be constructed of concrete or other nonabsorbent material having a smooth slip-resistant finish.

424.1.4 Electrical systems.

424.1.4.1 Electrical equipment and wiring. Electrical equipment wiring and installation, including the grounding of pool components shall conform with Chapter 27 of the *Florida Building Code, Building*.

424.1.4.2 Lighting. Artificial lighting shall be provided at all swimming pools which are to be used at night or which do not have adequate natural lighting so that all portions of the pool, including the bottom, may be readily seen without glare.

424.1.4.2.1 Outdoor pool lighting. Overhead lighting shall provide a minimum of 3 footcandles (30 lux) of illumination at the pool water surface and the pool deck surface. Underwater lighting shall be a minimum of $^{1}/_{2}$ watt per square foot of pool water surface area.

424.1.4.2.2 Indoor pool lighting. Overhead lighting shall provide a minimum of 10 foot candles of illumination at the pool water surface and the pool deck surface. Underwater lighting shall be a minimum of $^{8}/_{10}$ watt per square foot of pool surface area.

424.1.4.2.3 Underwater lighting. Underwater lighting shall utilize transformers and low-voltage circuits with each underwater light being grounded. The maximum voltage for each light shall be 15 volts and the maximum incandescent lamp size shall be 300 watts. The location of the underwater lights shall be such that the underwater illumination is as uniform as possible and shall not be less than 18 inches (457 mm) below the normal operating water level. All underwater lights which depend upon submersion for safe operation shall have protection from overheating when not submerged. Underwater lighting requirements can be waived when the overhead lighting provides at least 15 footcandles (150 lux) of illumination at the pool water surface and pool deck surface. Alternative lighting systems which do not utilize electricity in the pool or on the pool deck, such as fiber-optic systems, may be utilized if the applicant demonstrates to reasonable certainty that the system development has advanced to the point that the pool illumination is equal to the requirements in Sections 424.1.4.2.1 and 424.1.4.2.2 above.

424.1.4.2.4 Overhead wiring. Overhead service wiring shall comply with the currently adopted *National Electrical Code*, NFPA 70.

424.1.5 Equipment area or rooms.

424.1.5.1 Outdoor equipment. Equipment designated by the manufacturer for outdoor use may be located in an equipment area. An equipment area shall be enclosed by four-sided fencing that is at least 4 feet (1219 mm) high with a self-closing and self-latching gate and has a permanent locking device. An equipment room shall be protected on at least three sides and overhead. The fourth side may be a gate, fence, or open if otherwise protected from unauthorized entrance. The equipment area or room floor shall be of concrete or other nonabsorbent material having a smooth slip-resistant finish and shall have positive drainage, including a sump pump if necessary.

424.1.5.2 Indoor equipment. Equipment not designated by the manufacturer for outdoor use shall be located in an equipment room. An equipment room shall be protected on at least three sides and overhead. The fourth side may be a gate, fence or open if otherwise protected from unauthorized entrance.

424.1.5.3 materials. The equipment area or room floor shall be of concrete or other nonabsorbent material having a smooth slip-resistant finish and shall have positive drainage, including a sump pump if necessary.

424.1.5.4 Ventilation. Equipment rooms shall have either forced draft or cross ventilation. All below-grade

equipment rooms shall have a stairway access with forced draft ventilation or a fully louvered door and louvered vent on at least one other side.

424.1.5.5 Access. The opening to an equipment room or area shall be a minimum 3 feet by 6 feet (914 mm by 1829 mm) and shall provide easy access to the equipment.

424.1.5.6 Size. The size of the equipment room or area shall provide working space to perform routine operations. Clearance shall be provided for all equipment as prescribed by the manufacturer to allow normal maintenance operation and removal without disturbing other piping or equipment. In rooms with fixed ceilings, the minimum height shall be 7 feet (2137 mm).

424.1.5.7 Lighting. Equipment rooms or areas shall be lighted to provide 30 footcandles (300 lux) of illumination at floor level.

424.1.5.8 Storage. Equipment rooms or areas shall not be used for storage of chemicals emitting corrosive fumes or for storage of other items to the extent that entrance to the room for inspection or operation of the equipment is impaired.

424.1.5.9 Hose bibbs. A hose bibb with vacuum breaker shall be located in the equipment room or area.

424.1.6 Plumbing systems.

424.1.6.1 Sanitary facilities. Separate sanitary facilities shall be provided and labeled for each sex and shall be located within a 200-foot (60 960 mm) radius of the nearest water's edge of each pool served by the facilities.

Exception: Where a swimming pool serves only a designated group of residential dwelling units and not the general public, poolside sanitary facilities are not required if all living units are within a 200-foot (60 960 mm) radius of the nearest water's edge, are not over three stories in height and are each equipped with private sanitary facilities.

424.1.6.1.1 Required fixtures. Fixtures shall be provided as indicated on Table 424.1.6.1.

424.1.6.1.2 Outside access. Outside access to facilities shall be provided for bathers at outdoor pools. If they are not visible from any portion of the pool deck, signs shall be posted showing directions to the facilities. Directions shall be legible from any portion of the pool deck; letters shall be a minimum of 1 inch (25 mm) high.

424.1.6.1.3 Sanitary facility floors. Floors of sanitary facilities shall be constructed of concrete or other nonabsorbent materials, shall have a smooth, slip-resistant finish, and shall slope to floor drains. Carpets, duckboards and footbaths are prohibited. The intersection between the floor and walls shall be covered.

424.1.6.1.4 Hose bibb. A hose bibb with vacuum breaker shall be provided near each restroom to allow for ease of cleaning.

424.1.6.2 Rinse shower. A minimum of one rinse shower shall be provided on the pool deck of all outdoor pools within 20 feet (60 960 mm) of the nearest pool water's edge.

424.1.6.3 Cross-connection prevention. An atmospheric break or approved back flow prevention device shall be provided in each pool water supply line that is connected to a public water supply. Vacuum breakers shall be installed on all hose bibbs.

424.1.6.4 Plastic pipes. Plastic pipe subject to a period of prolonged sunlight exposure shall be coated to protect it from ultraviolet light degradation.

424.1.6.5 Recirculation and treatment systems.

424.1.6.5.1 Equipment testing. Recirculation and treatment equipment such as filters, recessed automatic surface skimmers, ionizers, ozone generators, disinfection feeders and chlorine generators shall be tested and approved using the ANSI/NSF International Standard 50, *Circulation System Components and Related materials for Swimming Pool, Spas/Hot Tubs*, dated October 28, 1996, which is incorporated by reference.

424.1.6.5.2 Volume. The recirculation system shall be designed to provide a minimum of four turnovers of the pool volume per day. Pools that are less than 1,000 square feet (93 m^3) at health clubs shall be required to provide eight turnovers per day.

424.1.6.5.3 System design. The design pattern of recirculation flow shall be 100 percent through the

TABLE 424.1.6.1
PUBLIC SWIMMING POOL FIXTURES REQUIRED

	MEN'S RESTROOM			WOMEN'S RESTROOM	
SIZE OF POOL	Urinals	WC	Lavatory	WC	Lavatory
0 - 2,500 sq. ft.	1	1	1	1	1
2,501 - 5,000 sq. ft.	2	1	1	5	1
5,001 - 7,500 sq. ft.	2	2	2	6	2
7,501 - 10,000 sq. ft.	3	3	3	9	3

For SI: 1 square foot = 0.0929 m^2.

An additional set of fixtures shall be provided in the men's restroom for every 5,000 square feet or major fraction thereof for pools greater than 10,000 square feet.

Women's restrooms shall have a ratio of three to two water closets provided for women as the combined total of water closets and urinals provided for men.

main drain piping and 100 percent through the perimeter overflow system or 60 percent through the skimmer system.

424.1.6.5.3.1 Perimeter overflow gutters. The lip of the gutter shall be uniformly level with a maximum tolerance of $^1/_4$ inch (6 mm) between the high and low areas. The bottom of the gutter shall be level or slope to the drains. The spacing between drains shall not exceed 10 feet (3048 mm) for 2-inch (51 mm) drains or 15 feet (4572 mm) for $2^1/_2$-inch (64 mm) drains, unless hydraulically justified by the design engineer.

424.1.6.5.3.1.1 Either recessed type or open type gutters shall be used. Special designs can be approved provided they are within limits of sound engineering practice. Recessed type gutters shall be at least 4 inches (102 mm) deep and 4 inches (102 mm) wide. No part of the recessed gutter shall be visible from a position directly above the gutter sighting vertically down the edge of the deck or curb. Open-type gutters shall be at least 6 inches (150 mm) deep and 12 inches (305 mm) wide. The gutter shall slope 2 inches (51 mm), +/-$^1/_4$ inch (+/-6 mm), from the lip to the drains. The gutter drains shall be located at the deepest part of the gutter.

424.1.6.5.3.1.2 All gutter systems shall discharge into a collector tank.

424.1.6.5.3.1.3 The gutter lip shall be tiled with a minimum of 2-inch (51 mm) tile on the pool wall. The back vertical wall of the gutter shall be tiled with glazed tile.

Exception: Stainless steel gutter systems when it can be shown that the surfaces at the waterline and back of the gutter are easily cleanable.

424.1.6.5.3.2 Recessed automatic surface skimmers. Recessed automatic surface skimmers may be utilized when the pool water surface area is 1,000 square feet (93 m^3) or less excluding offset stairs and swimouts and the width of the pool is not over 20 feet (6096 mm).

424.1.6.5.3.2.1 Volume. The recessed automatic surface skimmer piping system shall be designed to carry 60 percent of the pool total design flow rate with each skimmer carrying a minimum 30 gpm (2 L/s). One skimmer for every 400 square feet (37 m^2) or fraction thereof of pool water surface area shall be provided.

424.1.6.5.3.2.2 Location. Prevailing wind direction and the pool outline shall be considered in the selection of skimmer locations. The location of skimmers shall be such that the interference of adjacent inlets and skimmers is minimized. Recessed automatic surface skimmers shall be installed so that there is no protrusion into the pool water area. The deck or curb shall provide for a handhold around the entire pool perimeter and shall not be located more than 9 inches (229 mm) above the mid point of the opening of the skimmer.

424.1.6.5.3.2.3 Equalizers. Recessed automatic surface skimmers shall be installed with an equalizer valve and an equalizer line when the skimmer piping system is connected directly to pump suction. The equalizer valve shall be a spring loaded vertical check valve which will not allow direct suction on the equalizer line. The equalizer line inlet shall be installed at least 1 foot (305 mm) below the normal pool water level and the equalizer line inlet shall be protected by a grate. The equalizer line shall be sized to handle the expected flow with a 2-inch (51 mm) minimum line size.

424.1.6.5.3.2.4 Wall-inlet fitting. A wall-inlet fitting shall be provided directly across from each skimmer.

424.1.6.5.3.2.5 Waterline tile. A minimum 6-inch (152 mm) water line tile shall be provided on all pools with automatic skimmer systems. Glazed tile shall be utilized.

424.1.6.5.4 Pumps. If the pump or suction piping is located above the water level of the pool, the pump shall be self-priming. Pumps that take suction prior to filtration shall be equipped with a hair and lint strainer. The recirculation pump shall be selected to provide the required recirculation flow against a minimum total dynamic head of 60 feet (18 288 mm) unless hydraulically justified by the design engineer. Vacuum D.E. filter system pumps shall provide at least 50 feet (15 240 mm) of total dynamic head. Should the total dynamic head required not be appropriate for a given project, the design engineer shall provide an alternative.

424.1.6.5.5 Filters. Filters sized to handle the required recirculation flow shall be provided.

424.1.6.5.5.1 Filter capacities. The maximum filtration rate in gallons per minute per square foot of filter area shall be: 15 (20 if so approved using the procedure stated in Section 424.1.6.5.1 for high rate sand filters, 3 for rapid sand filters, 0.075 for pleated cartridge filters and 2 for D.E. filters).

424.1.6.5.5.2 Filter appurtenances.

424.1.6.5.5.2.1 Pressure filter systems. Pressure filter systems shall be equipped with an air relief valve, influent and effluent pressure gauges with minimum face size of 2 inches (51 mm) reading 0-60 psi (0-414 kPa), and a sight glass when a backwash line is required.

424.1.6.5.5.2.2 Vacuum filter systems. Vacuum filter systems shall be equipped with a vacuum gauge which has a 2-inch (51 mm) face and reads from 0-30 inches of mercury.

424.1.6.5.5.2.3 D.E. systems. A precoat pot or collector tank shall be provided for D.E. systems.

424.1.6.5.5.3 Filter tanks and elements. The filter area shall be determined on the basis of effective filtering surfaces with no allowance given for areas of impaired filtration, such as broad supports, folds, or portions which may bridge. Filter elements shall have a minimum 1-inch (25 mm) clear spacing between elements up to a 4 square foot (.4 m^2) effective area. The spacing between filter elements shall increase $^1/_8$ inch (3 mm) for each additional square foot of filter area or fraction thereof above an effective filter area of 4 square feet (.4 m^2). All cartridges used in public pool filters shall be permanently marked with the manufacturer's name, pore size and area in square feet of filter material. All cartridges with end caps shall have the permanent markings on one end cap. Vacuum filter tanks shall have covered intersections between the wall and the floor and the tank floor shall slope to the filter tank drain. The filter tank and elements shall be installed such that the recirculation flow draw down does not expose the elements to the atmosphere whenever only the main drain valve is open or only the surface overflow gutter system valve is open.

424.1.6.5.6 Piping. All plastic pipe used in the recirculation system shall be imprinted with the manufacturer's name and the NSF-pw logo for potable water applications. Size, schedule and type of pipe shall be included on the drawings. Plastic pipe subject to a period of prolonged sunlight exposure shall be coated to protect it from ultraviolet light degradation.

424.1.6.5.7 Valves. Return lines, main drain lines, and surface overflow system lines, shall each have proportioning valves.

424.1.6.5.8 Flow velocity. Pressure piping shall not exceed 8 feet per second (2438 mm/s), except that precoat lines with higher velocities may be used when necessary for agitation purposes. The flow velocity in suction piping shall not exceed 6 feet per second (1829 mm/s) except that flow velocities up to 10 feet per second (3048 mm/s) in filter assembly headers will be acceptable. main drain systems and surface overflow systems which discharge to collector tanks shall be sized with a maximum flow velocity of 3 feet per second (914 mm/s). The filter and vacuuming system shall have the necessary valves and piping to allow filtering to pool, vacuuming to waste, vacuuming to filter, complete drainage of the filter tank, backwashing for sand and pressure D.E. filters and precoat recirculation for D.E. filters.

424.1.6.5.9 Inlets. All inlets shall be adjustable with wall type inlets being directionally adjustable and floor type inlets having a means of flow adjustment.

424.1.6.5.9.1 Pools 30 feet (9144 mm) in width or less, with wall inlets only shall have enough inlets such that the inlet spacing does not exceed 20 feet (6096 mm) based on the pool water perimeter.

424.1.6.5.9.2 Pools 30 feet (9144 mm) in width or less with floor inlets only shall have a number of inlets provided such that the spacing between adjacent inlets does not exceed 20 feet (6096 mm) and the spacing between inlets and adjacent walls does not exceed 10 feet (3048 mm).

424.1.6.5.9.3 A combination of wall and floor inlets may be used in pools 30 feet (9144 mm) in width or less only if requirements of Section 424.1.6.5.9.1 or Section 424.1.6.5.9.2 are fully met.

424.1.6.5.9.4 Pools greater than 30 feet (9144 mm) in width with floor inlets only shall have a number of floor inlets provided such that the spacing between adjacent inlets does not exceed 20 feet (6096 mm) and the spacing between inlets and an adjacent wall does not exceed 10 feet (3048 mm).

424.1.6.5.9.5 Pools greater than 30 feet (9144 mm) in width may have a combination of wall and floor inlets provided the number of wall inlets is such that the maximum spacing between wall inlets is 20 feet (6096 mm) and floor inlets are provided for the pool water area beyond a 15 feet (4572 mm) perpendicular distance from all walls. The number of floor inlets shall be such that the spacing between adjacent inlets does not exceed 20 feet (6096 mm) and the distance from a floor inlet and an adjacent wall does not exceed 25 feet (7620 mm). Floor inlets shall be designed and installed such that they do not protrude more than $^5/_8$ inch (16 mm) above the pool floor and all inlets shall be designed and installed so as not to constitute sharp edges or protrusions hazardous to pool bathers.

424.1.6.5.9.6 The flow rate through each inlet shall not exceed 15 gpm (1 L/s).

424.1.6.5.10 Main drain outlets. All pools shall be provided with an outlet at the deepest point.

424.1.6.5.10.1 The depth at the outlet shall not deviate more than 3 inches (76 mm) from the side wall.

424.1.6.5.10.2 Outlets shall be covered by a secured grating which requires the use of a tool to remove and whose open area is such that the maximum velocity of water passing through the openings does not exceed $1^1/_2$ feet per second (457 mm/s) at 100 percent of the design recirculation flow.

424.1.6.5.10.3 Multiple outlets, equally spaced from the pool side walls and from each other, shall be installed in pools where the deep portion of the pool is greater than 30 feet (9144 mm) in width.

424.1.6.5.10.4 If the area is subject to high ground water, the pool shall be designed to withstand hydraulic uplift or shall be provided with hydrostatic relief devices.

424.1.6.5.10.5 The main drain outlet shall be connected to a collector tank. The capacity of the collector tank shall be at least 1 minute of the recirculated flow unless justified by the design engineer. Vacuum filter tanks are considered collector tanks.

424.1.6.5.11 Water makeup control. An automatic and manual water makeup control shall be provided to maintain the water level at the lip of the overflow gutter or at the mouth of the recessed automatic surface skimmers and shall discharge through an air gap into a fill pipe or collector tank. Over the rim fill spouts are prohibited.

424.1.6.5.12 Cleaning system. A portable or plumbed in vacuum cleaning system shall be provided. All vacuum pumps shall be equipped with hair and lint strainers. When the system is plumbed in, the vacuum fittings shall be located to allow cleaning the pool with a 50-foot (15 240 mm) maximum length of hose. Vacuum fittings shall be mounted approximately 12 inches (305 mm) below the water level, flush with the pool walls, and shall be provided with a spring loaded safety cover or flush plug cover which shall be in place at all times when the pool is not being vacuumed. Bag-type cleaners, which operate as ejectors on potable water supply pressure, shall be protected by a vacuum breaker. Cleaning devices shall not be used while the pool is open to bathers.

424.1.6.5.13 Rate of flow indicators. A rate of flow indicator, reading in gpm, shall be installed on the return line. The rate of flow indicator shall be properly sized for the design flow rate and shall be capable of measuring from one-half to at least one-and-one-half times the design flow rate. The clearances upstream and downstream from the rate of flow indicator shall comply with manufacturer's installation specifications.

424.1.6.5.14 Heaters. Pool heaters shall comply with nationally recognized standards acceptable to the department and to the design engineer. Pools equipped with heaters shall have a fixed thermometer mounted in the pool recirculation line downstream from the heater outlet. Thermometers mounted on heater outlets do not meet this requirement. A sketch of any proposed heater installation including valves, thermometer, pipe sizes, and material specifications shall be included in the application for permit prior to installation. Piping and influent, effluent and bypass valves which allow isolation or removal of the heater from the system shall be provided. materials used in solar and other heaters shall be nontoxic and acceptable for use with potable water. Heaters shall not prevent the attainment of the required turnover rate.

424.1.6.5.15 Pool waste water disposal. Pool waste water shall be discharged through an air gap; disposal shall be to sanitary sewers, storm sewers, drainfields, or by other means, in accordance with local requirements including obtaining all necessary permits. Disposal of water from pools using D.E. powder shall be accomplished through separation tanks which are equipped with air bleed valves, bottom drain lines, and isolation valves, or through a settling tank with final disposal being acceptable to local authorities. D.E. separator tanks shall have a capacity as rated by the manufacturer, equal to the square footage of the filter system. All lines shall be sized to handle the expected flow. There shall not be a direct physical connection between any drain from a pool or recirculation system and a sewer line.

424.1.6.5.16 Addition of chemicals. Disinfection and pH adjustment shall be added to the pool recirculation flow using automatic feeders meeting the requirement of ANSI/NSF 50. All chemicals shall be fed into the return line after the pump, heater and filters unless the feeder was designed by the manufacturer and approved by the NSF to feed to the collector tank or to the suction side of the pump.

424.1.6.5.16.1 Gas chlorination. When gas chlorination is utilized, the chlorinator shall be capable of continuously feeding a chlorine dosage of 4 mg/L to the recirculated flow of the filtration system. The application point for chlorine shall be located in the return line downstream of the filter, recirculation pump, heater, and flow meter, and as far as possible from the pool.

424.1.6.5.16.1.1 Gas chlorinators shall be located in above-grade rooms and in areas which are inaccessible to unauthorized persons.

424.1.6.5.16.1.1.1 Chlorine rooms shall have: continuous forced draft ventilation capable of a minimum of one air change per minute with an exhaust at floor level to the outside, a minimum of 30 footcandles (300 lux) of illumination with the switch located outside and the door shall open out and shall not be located adjacent to the filter room entrance or the pool deck. A shatterproof gas-tight inspection window shall be provided.

424.1.6.5.16.1.1.2 Chlorine areas shall have a roof and shall be enclosed by a chain-link type fence at least 6 feet (1829 mm) high to allow ventilation and prevent vandalism.

424.1.6.5.16.1.2 When booster pumps are used with the chlorinator, the pump shall use recirculated pool water supplied via the recirculation filtration system. The booster pump shall be electrically interlocked with the recirculation pump to prevent the feeding of chlorine when the recirculation pump is not operating.

424.1.6.5.16.1.3 A means of weighing chlorine containers shall be provided. When 150-pound (68 kg) cylinders are used, platform type scales shall be provided and shall be capable of weighing a minimum of two full cylinders at one time.

The elevation of the scale platform shall be within 2 inches (51 mm) of the adjacent floor level, and the facilities shall be constructed to allow easy placement of full cylinders on the scales.

424.1.6.5.16.2 Hypohalogenation and electrolytic chlorine generators. The hypohalogenation type feeder and electrolytic chlorine generators shall be adjustable from 0 to full range. A rate of flow indicator is required on erosion type feeders. The feeders shall be capable of continuously feeding a dosage of 6 mg/L to the minimum required turnover flow rate of the filtration systems. Solution feeders shall be capable of feeding the above dosage using a 10-percent sodium hypochlorite solution, or 5-percent calcium hypochlorite solution, whichever disinfectant is to be utilized at this facility. To prevent the disinfectant from siphoning or feeding directly into the pool or pool piping under any type failure of the recirculation equipment, an electrical interlock with the recirculation pump shall be incorporated into the system for electrically operated feeders. The minimum size of the solution reservoirs shall be at least 50 percent of the maximum daily capacity of the feeder. The solution reservoirs shall be marked to indicate contents.

424.1.6.5.16.3 Feeders for pH adjustment. Feeders for pH adjustment shall be provided on all pools, except spa pools of less than 100 square feet (9 m^2) of pool water surface area and pools utilizing erosion type chlorinators feeding chlorinated isocyanurates. pH adjustment feeders shall be positive displacement type, shall be adjustable from 0 to full range, and shall have an electrical interlock with the circulation pump to prevent discharge when the recirculation pump is not operating. When soda ash is used for pH adjustment, the maximum concentration of soda ash solution to be fed shall not exceed $^1/_2$-pound (.2 kg) soda ash per gallon of water. Feeders for soda ash shall be capable of feeding a minimum of 3 gallons (11 L) of the above soda ash solution per pound of gas chlorination capacity. The minimum size of the solution reservoirs shall not be less than 50 percent of the maximum daily capacity of the feeder. The solution reservoirs shall be marked to indicate the type of contents.

424.1.6.5.16.4 Ozone generating equipment. Ozone generating equipment may be used for supplemental water treatment on public swimming pools subject to the conditions of this section.

424.1.6.5.16.4.1 Ozone generating equipment electrical components and wiring shall comply with the requirements of the Chapter 27 of the *Florida Building Code, Building* and the manufacturer shall provide a certificate of conformance. The process equipment shall be provided with an effective means to alert the user when a component of this equipment is not operating.

424.1.6.5.16.4.2 Ozone generating equipment shall meet the NSF 50.

424.1.6.5.16.4.3 The concentration of ozone in the return line to the pool shall not exceed 0.1 mg/L.

424.1.6.5.16.4.4 The injection point for ozone generating equipment shall be located in the pool return line after the filtration and heating equipment, prior to the halogen injection point, and as far as possible from the nearest pool return inlet with a minimum distance of 4 feet (1219 mm). Injection methods shall include a mixer, contact chamber, or other means of efficiently mixing the ozone with the recirculated water. The injection and mixing equipment shall not prevent the attainment of the required turnover rate of the recirculation system. Ozone generating equipment shall be equipped with a check valve between the generator and the injection point. Ozone generating equipment shall be equipped with an air flow m and a means to control the flow.

424.1.6.5.16.4.5 Ventilation requirements. Ozone generating equipment shall be installed in equipment rooms with either forced draft or cross draft ventilation. Below-grade equipment rooms with ozone generators shall have forced draft ventilation and all equipment rooms with forced draft ventilation shall have the fan control switch located outside the equipment room door. The exhaust fan intake for forced draft ventilation and at least one vent grille for cross draft ventilation shall be located at floor level.

424.1.6.5.16.4.6 A self-contained breathing apparatus designed and rated by its manufacturer for use in ozone contaminated air shall be provided when ozone generator installations are capable of exceeding the maximum pool water ozone contact concentration of 0.1 milligram per liter. The self-contained breathing apparatus shall be available at all times and shall be used at times when the maintenance or service personnel have determined that the equipment room ozone concentration exceeds 10 mg/L. Ozone generator installations which require the self-contained breathing apparatus shall also be provided with Draeger-type detector tube equipment which is capable of detecting ozone levels of 10 mg/L and greater.

Exception: In lieu of the self-contained breathing apparatus an ozone detector capable of detecting 1 mg/L may be used. Said detector shall be capable of stopping the production of ozone, venting the room and sounding an alarm once ozone is detected.

424.1.6.5.16.5 Ionization units may be used as supplemental water treatment on public pools subject to the condition of this section.

424.1.6.5.16.5.1 Ionization equipment and electrical components and wiring shall comply with the requirements of Chapter 27 of the *Florida Building Code, Building* and the manufacturer shall provide a certification of conformance.

424.1.6.5.16.5.2 Ionization equipment shall meet the NSF 50, *Circulation System Components and Related materials for Swimming Pools, Spas/Hot Tubs,* or equivalent, shall meet UL standards and shall be electrically interlocked with recirculation pump.

424.1.7 Wading pools.

424.1.7.1 General. Wading pools shall meet the requirements of Sections 424.1.1 through 424.1.6.5, unless otherwise indicated. Wading pools and associated piping shall not be physically connected to any other swimming pools and have no minimum width dimensions requirements.

424.1.7.2 Depths. Wading pools shall have a maximum of 2 feet (610 mm). The depth at the perimeter of the pool shall be uniform and shall not exceed 12 inches (305 mm). Where recessed automatic surface skimmers are used, the pool floor shall not be more than 12 inches (305 mm) below the deck unless steps and handrails are provided. Depth and "NO DIVING" markers are not required on wading pools.

424.1.7.3 Recirculation. Wading pools shall have a minimum of one turnover every hour. Lines from main drains shall discharge into a collector tank.

424.1.7.3.1 Skimmer equalizer lines when required shall be installed in the pool floor with a grate covering.

424.1.7.3.2 The grate cover shall be sized so as not to allow the flow to exceed $1^1/_2$ feet per second (457 mm/s) when the equalizer line is operating.

424.1.7.4 Inlets. Wading pools with 20 feet (6096 mm) or less of perimeter shall have a minimum of two equally spaced adjustable inlets.

424.1.7.5 Emergency drainage. All wading pools shall have drainage to waste without a cross connection through a quick opening valve to facilitate emptying the wading pool should accidental bowel or other discharge occur.

424.1.7.6 Vacuuming. Wading pools with 200 square feet (19 mm) or more of pool water surface area shall have provisions for vacuuming.

424.1.7.7 Wading pool decks. When adjacent to swimming pools, wading pools shall be separated from the swimming pool by a fence or other similar type barrier. Wading pools shall have a minimum 10-foot (3048 mm) wide deck around at least 50 percent of their perimeter with the remainder of the perimeter deck being at least 4 feet (1219 mm) wide. There shall be at least 10 feet (3048 mm) between adjacent swimming pools and wading pools.

424.1.7.8 Lighting. Wading pools are exempt from underwater lighting requirements but shall have overhead lighting installed for night use.

424.1.8 Spa pools.

424.1.8.1 General. Spa pools shall meet the requirements of Sections 424.1.1 through 424.1.6.5, unless specifically indicated otherwise.

424.1.8.2 Color, pattern, finish. The color, pattern or finish of the pool interior shall not obscure the existence or presence of objects or surfaces within the pool.

424.1.8.3 Water depths. Spa type pools shall have a minimum water depth of $2^1/_2$ feet (762 mm) and a maximum water depth of 4 feet (1219 mm), except that swim spa pools may have a maximum water depth of 5 feet (1524 mm). Depth markers and "NO DIVING" markers are not required on spa-type pools with 200 square feet (19 m^2) or less of water surface area.

424.1.8.4 Steps and handrails. Steps or ladders shall be provided and shall be located to provide adequate entrance to and exit from the pool. The number of sets of steps or ladders required shall be on the basis of one for each 75 feet (22 860 mm), or major fraction thereof, of pool perimeter. Step sets for spa type pools with more than 200 square feet of pool water surface area shall comply with Section 424.1.2.5. Step sets for spa-type pools with 200 square feet (19 m^2) or less of pool water surface area shall comply with the following: Step treads shall have a minimum width of 10 inches (254 mm) for a minimum continuous tread length of 12 inches (305 mm). Step riser heights shall not exceed 12 inches (305 mm) except when the bottom step is used for a bench or seat, the bottom riser may be a maximum of 14 inches (356 mm). Intermediate treads and risers between the top and bottom treads and risers shall be uniform in width and height, respectively. Contrasting markings on the leading edges of the submerged benches and the intersections of the treads and risers are required to be installed in accordance with Section 424.1.2.5.

424.1.8.4.1 Handrails shall be provided for all sets of steps and shall be anchored in the bottom step and in the deck. Handrails shall be located to provide maximum access to the steps and handrails shall extend 28 inches (711 mm) above the pool deck.

424.1.8.4.2 Where "figure 4" handrails are used, they shall be anchored in the deck and shall extend laterally to any point vertically above the bottom step. Handrails shall be located to provide maximum access to the steps and handrails shall extend 28 inches (711 mm) above the pool deck.

424.1.8.5 Decks. Decks shall have a minimum 4-foot-wide (1219 mm) unobstructed width around the entire pool perimeter except that pools of less than 120 square feet (11 m^2) of pool water surface area shall have a minimum 4-foot-wide (1219 mm)unobstructed continuous deck around a minimum of 50 percent of the pool

perimeter. Decks less than 4 feet (1219 mm) wide shall have barriers to prevent their use. Decks shall not be more than 10 inches (254 mm) below the top of the pool.

424.1.8.6 Therapy or jet systems.

424.1.8.6.1 The return lines of spa-type therapy or jet systems shall be independent of the recirculation-filtration and heating systems.

424.1.8.6.2 Therapy or jet pumps shall take suction from the collector tank. Collector tank sizing shall take this additional gallonage into consideration.

424.1.8.7 Filtration system inlets. Spa-type pools with less than 20 feet (6096 mm) of perimeter shall have a minimum of two equally spaced adjustable inlets.

424.1.8.8 Filtration recirculation. Spa-type pools shall have a minimum of one turnover every 30 minutes. The piping, fittings, and hydraulic requirements shall be in accordance with Section 424.1.6.5. All recirculation lines to and from the pool shall be individually valved with proportional flow-type valves in order to control the recirculation flow.

424.1.8.9 Vacuuming. Spa-type pools of over 200 square feet (19 m^2) of pool water surface area shall have provisions for vacuuming.

424.1.8.10 Combination spas/pools. When spa pools are part of a conventional swimming pool, the spa pool area shall be offset from the main pool area with the same water depth as the main pool area. The spa pool shall meet all the spa pool requirements of this chapter, and the deck area at the spa shall be protected by connected 30-inch-high (762 mm) stanchions. The deck perimeter at the offset spa area shall not exceed 15 percent of the entire swimming pool perimeter. All benches shall have contrasting markings on the leading edges of the intersection of the bench seats. If tile is used, it shall be slip resistant.

424.1.8.11 Portable and wooden spa pools. Portable and wooden-type spa pools are prohibited.

424.1.9 Water recreation attractions and specialized pools.

424.1.9.1 General. Water recreation attraction projects shall be designed and constructed within the limits of sound engineering practice. In addition to the requirements of this section, compliance is required with Sections 424.1.1 through 424.1.6.5 of this chapter depending upon the pool design and function. Additionally, all pools listed in this section shall have a 3-hour turnover rate unless otherwise noted.

424.1.9.2 Water slides.

424.1.9.2.1 Water slide plunge pool. Plunge pools shall be constructed of concrete or other structurally rigid impervious materials with a nontoxic, smooth and slip resistant finish. The plunge pool design shall meet the criteria of Sections 424.1.9.2.1.1 through 424.1.9.2.1.7.

424.1.9.2.1.1 Plunge pool water depth. The minimum plunge pool operating water depth at the slide flume terminus shall be 3 feet (914 mm). This depth shall be maintained for a minimum distance of 10 feet (3048 mm) in front of the slide terminus from which point the plunge pool floor may have a constant upward slope to allow a minimum water depth of 2 feet (51 mm) at the base of the steps. The floor slope shall not exceed 1 in 10. The plunge pool water depth shall be commensurate with safety and the ease of exit from the plunge pool.

424.1.9.2.1.2 Plunge pool dimension. The plunge pool dimension between any slide flume exit or terminus and the opposite side of the plunge pool shall be a minimum of 20 feet (6096 mm) excluding steps.

424.1.9.2.1.3 Slide flume terminus.

424.1.9.2.1.3.1 The slide flume terminus shall be designed by the design engineer who can demonstrate to the department's satisfaction that riders will be adequately slowed prior to discharge so as to prevent injury or harm to the rider upon impact with the plunge pool water.

424.1.9.2.1.3.2 The minimum distance between any plunge pool side wall and the outer edge of any slide terminus shall be 5 feet (1524 mm). The minimum distance between adjacent slide flumes shall be 6 feet (18 288 mm).

424.1.9.2.1.3.3 A minimum length of slide flume of 10 feet (3048 mm) shall be perpendicular to the plunge pool wall at the exit end of the flumes.

424.1.9.2.1.4 Plunge pool main drains. The plunge pool shall have a minimum of one main drain with separate piping and valve to the filtration system collector tank. The velocity through the openings of the main drain grate shall not exceed $1^1/_2$ feet per second (457 mm/s) at the design flow rate of the recirculation pump. The main drain piping shall be sized to handle 100 percent of the design flow rate of the filtration system with a maximum flow velocity of 3 feet (914 mm) per second.

424.1.9.2.1.5 Plunge pool floor slope. The plunge pool floor shall slope to the main drains and the slope shall not exceed 1 in 10.

424.1.9.2.1.6 Plunge pool decks.

424.1.9.2.1.6.1 Width. The minimum width of plunge pool decks along the exit side shall be 10 feet (3048 mm). There shall be a pool deck along the side opposite the plunge pool weir, and this deck shall have a minimum width of 4 feet (1219 mm).

424.1.9.2.1.6.2 Curbs. All plunge pool decks shall have a minimum 6-inch-high (152 mm) curb or adequate freeboard to contain the water

surge generated by the person entering the water via the slide.

424.1.9.2.1.6.3 Slopes. All plunge pool decks shall slope away from the plunge pool unless the curb is located at the outside perimeter of the deck. If the curb is located at the outside perimeter of the deck, the plunge pool deck shall slope to the plunge pool or pump reservoir or to deck drains which discharge to waste. All slopes shall be between 2- and 4-percent grade.

424.1.9.2.1.7 Hand holds. Hand holds shall be provided along the sides of the plunge pool in areas where the water depth exceeds 3 feet (914 mm), except that no hand holds shall be required along the wall where the slide enters the pool nor shall they be required at the pool exit.

424.1.9.2.2 Run out lanes.

424.1.9.2.2.1 Run out lanes may be utilized in lieu of a plunge pool system, provided they are constructed to the slide manufacturers specifications and are approved by the design engineer of record.

424.1.9.2.2.2 Eight-foot-wide (2438 mm) walkways shall be provided adjacent to run out lanes.

424.1.9.2.2.3 Minimum water level indicator markings shall be provided on both sides of the run out trough to ensure adequate water for the safe slowing of pool patrons.

424.1.9.2.2.4 Water park personnel shall be provided at the top of the slides and at the run out.

424.1.9.2.3 Pump reservoirs. Pump reservoirs shall be made of concrete or other impervious material with a smooth slip-resistant finish and shall be connected to the plunge pool by a weir. Pump reservoirs shall be for the slide pump intakes. Pump reservoir designs shall meet the criteria of Sections 424.1.9.2.3.1 through 424.1.9.2.3.5.

424.1.9.2.3.1 Pump reservoir volume. The minimum reservoir volume shall be equal to 2 minutes of the combined flow rate in gallons per minute of all filter and slide pumps.

424.1.9.2.3.2 Pump reservoir security. Pump reservoirs shall be accessible only to authorized individuals.

424.1.9.2.3.3 Pump reservoir maintenance accessibility. Access decks shall be provided for the reservoir such that all areas are accessible for vacuuming, skimming, and maintenance. The decks shall have a minimum width of 3 feet (914 mm) and shall have a minimum slope of 3:10 away from the reservoir.

424.1.9.2.3.4 Pump reservoir slide pump intakes. The slide pump intakes shall be located in the pump reservoir and shall be designed to allow cleaning without danger of operator entrapment.

424.1.9.2.3.5 Pump reservoir main drains. The pump reservoir shall have a minimum of one main drain with separate piping and valve to the filtration system collector tank and the velocity through the openings of the main drain grates shall not exceed 1½ feet per second (457 mm/s) at the design flow rate of the filtration system pump. The main drain piping shall be sized to handle 100 percent of design flow rate of the filtration system pump with a maximum flow velocity of 3 feet per second (914 mm/s).

424.1.9.2.4 Slide pump check valves. Slide pumps shall have check valves on all discharge lines.

424.1.9.2.5 Perimeter overflow gutters or skimmers. Plunge pools and pump reservoirs shall have perimeter overflow gutter system or skimmer which shall be an integral part of the filtration system.

424.1.9.2.5.1 Perimeter overflow gutter systems. Perimeter overflow gutter systems shall meet the requirements of Section 424.1.6.5.3.1 except that gutters are not required directly under slide flumes or along the weirs which separate plunge pools and pump reservoirs.

424.1.9.2.5.2 Surface skimmers. Surface skimmers may be used in lieu of perimeter overflow gutters and shall be appropriately spaced and located according to the structural design. Unless an overflow gutter system is used, surface skimmers shall be provided in the plunge pool and in the pump reservoir and the skimmer system shall be designed to carry 60 percent of the filtration system design flow rate with each skimmer carrying a minimum 30 gpm (2 L/s). All surface skimmers shall meet the requirements for NSF commercial approval as set forth in NSF 50, *Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tub*s, which is incorporated by reference in these rules, including an equalizer valve in the skimmer and an equalizer line to the pool wall on systems with direct connection to pump suction.

424.1.9.2.6 Water slide recirculation–filtration equipment.

424.1.9.2.6.1 Recirculation rate. The recirculation-filtration system of water slides shall recirculate and filter a water volume equal to the total water volume of the facility in a period of 3 hours or less.

424.1.9.2.6.2 Filter areas. minimum filter area requirements shall be twice the filter areas specified for the recirculation rates stipulated in Section 424.1.6.5.5.1. The filtration system shall be capable of returning the pool water turbidity to 5/10 NTU within 8 hours or less after peak bather load.

424.1.9.2.6.3 Hair and lint strainer. Any filtration system pump which takes suction directly from the plunge pool and reservoir shall have a

minimum 8-inch (208 mm) diameter hair and lint strainer on the suction side of the pump.

424.1.9.2.7 Disinfection. The disinfection equipment shall be capable of feeding 12 mg/L of halogen to the continuous recirculation flow of the filtration system.

424.1.9.3 Water activity pools.

424.1.9.3.1 Water activity pools shall be designed and constructed within the limits of sound engineering practice. The design engineer may consult with the department prior to preparation and submission of engineering plans and specifications for water activity pools.

424.1.9.3.2 Water activity pools shall be constructed of concrete or other structurally rigid impervious materials with a nontoxic, smooth and slip-resistant finish. These pools shall be of such shape and design as to be operated and maintained in a safe and sanitary manner.

424.1.9.3.3 The recirculation-filtration system of water activity pools shall be capable of a minimum of one turnover every 3 hours.

424.1.9.4 Wave pools.

424.1.9.4.1 Wave pools shall be designed and constructed within the limits of sound engineering practice.

424.1.9.4.2 Wave pools shall be constructed of concrete or other impervious materials with a smooth slip-resistant finish. These pools shall be of such shape and design as to be operated and maintained in a safe and sanitary manner.

424.1.9.4.3 The recirculation-filtration system of wave pools shall be capable of a minimum of one turnover every 3 hours.

424.1.9.5 Lazy river rides.

424.1.9.5.1 Lazy river rides shall be constructed within the limits of sound engineering practice.

424.1.9.5.2 Lazy river rides shall be constructed on concrete or other impervious materials with a nontoxic, smooth and slip-resistant finish. These rides shall be of such shape and design as to be operated in a safe and sanitary manner.

424.1.9.5.3 The recirculation-filtration system of the lazy river ride shall be capable of a minimum of one turnover every 3 hours.

424.1.9.5.4 The maximum water depth of the lazy river ride shall not exceed 3 feet (914 mm) unless justified to the department's satisfaction by the design engineer.

424.1.9.5.5 Decking shall be provided at the entrance and exit points as necessary to provide safe patron access but shall not be smaller than 10 feet (3048 mm) in width and length. Additional decking along the ride course is not required except that decking shall be required at lifeguard locations and emergency exit points.

424.1.9.5.6 Access and exit shall be provided at the start and end of the ride only, except that emergency exit locations shall be located along the ride course as necessary to provide for the safety of the patrons.

424.1.9.6 Zero depth entry pools.

424.1.9.6.1 Zero depth entry pools shall have a continuous floor slope from the water edge to the deep end.

424.1.9.6.2 The deck level perimeter overflow system with grate shall be provided at the waters edge across the entire zero depth portion of the pool.

424.1.9.6.3 The pool deck may slope toward the pool for no more than 5 feet (1524 mm), as measured from the overflow system grate outward. Beyond this area the deck shall slope away from the pool in accordance with Section 424.1.2.2.3.

424.1.9.6.4 Barriers and no-entry signs shall be provided along the pool wall edge where the water depth is less than 3 feet (914 mm) deep. No-entry signs shall be slip-resistant, shall have 4-inch-high (102 mm) letters, shall be located within 2 feet (610 mm) of the pool edge and shall be spaced no more than 15 feet (4572 mm) apart.

424.1.9.6.5 Additional inlets shall be provided in areas of less than 18 inches (457 mm) deep. The numbers and location shall be such as to double the flow rate into this area.

424.1.9.7 Special purpose pools.

424.1.9.7.1 General. Special purpose pool projects may deviate from the requirements of other sections of these rules provided the design and construction are within the limits of sound engineering practice. Only those deviations necessary to accommodate the special usage shall be allowed and all other aspects of the pool shall comply with the requirements of this section and with Section 424.1.2.

424.1.9.7.2 A special purpose pool may incorporate ledges which do not overhang into the pool.

424.1.9.8 Interactive water features.

424.1.9.8.1 Waters discharged from all fountain or spray features shall not pond on the feature floor but shall flow by gravity through a main drain fitting to a below grade sump or collection system which discharges to a collector tank. The minimum size of the sump or collector tank shall be equal to the volume of 2 minutes of the combined flow of all feature pumps and the filter pump. Smaller tanks may be utilized if hydraulically justified by the design engineer. Adequate access shall be provided to the sump or collector tank. Stairs or a ladder shall be provided as needed to ensure safe entry into the tank.

424.1.9.8.2 When an underground sump is utilized, an automatic skimmer system shall be provided. A variable height skimmer may be used or a custom surface skimmer device may be substituted if deemed appropriate by both the design engineer and the department.

424.1.9.8.3 Chemical feeders shall be provided in accordance with Section 424.1.6.5; except that the disinfection feeder shall be capable of feeding 12 ppm of free chlorine to the filter return piping.

424.1.9.8.4 If night operation is proposed, 6 footcandles (60 lux) of light shall be provided on the pool deck and the water feature area. Lighting that may be exposed to the feature pool water shall not exceed 15 volts, shall be installed in accordance with manufacturer's specifications and be approved for such use by UL or NSF.

424.1.9.8.5 All electrical work shall comply with Chapter 27 of the *Florida Building Code, Building*.

424.1.9.8.6 Hydraulics.

424.1.9.8.6.1 The filter system shall be capable of filtering and treating the entire water volume of the water feature within 30 minutes. The filter system shall draft from the collector tank and return filtered and treated water to the tank via equally spaced inlet fittings. The flow rate through these fittings shall not exceed 20 gpm (1.3 L/s).

424.1.9.8.6.2 The water feature pump shall draft from the collector tank.

424.1.9.8.6.3 An automatic water level controller shall be provided.

424.1.9.8.6.4 The flow rate through the feature nozzles of the water features shall be such as not to harm the patrons and shall not exceed 20 feet per second (6096 mm/s) unless justified by the design engineer and by the fountain system manufacturer.

424.2 Private swimming pools.

424.2.1 Definitions–general.

424.2.1.1 Tense, gender and number. For the purpose of this code, certain abbreviations, terms, phrases, words, and their derivatives shall be construed as set forth in this section. Words used in the present tense include the future. Words in the masculine gender include the feminine and neuter. Words in the feminine and neuter gender include the masculine. The singular number includes the plural and the plural number includes the singular.

424.2.1.2 Words not defined. Words not defined herein shall have the meanings stated in the *Florida Building Code, Building*; *Florida Building Code, Mechanical*; *Florida Building Code, Plumbing*; *Florida Building Code, Fuel Gas*; or *Florida Fire Prevention Code*. Words not defined in the *Florida Building Code* shall have the meanings stated in the *Webster's Ninth New Collegiate Dictionary*, as revised.

424.2.2 Definitions.

ABOVE-GROUND/ON-GROUND POOL. See "Swimming pool."

ADMINISTRATIVE AUTHORITY. The individual official, board, department or agency established and authorized by a state, county, city or other political subdivision created by law to administer and enforce the provisions of the swimming pool code as adopted or amended.

APPROVED. Accepted or acceptable under an applicable specification stated or cited in this code, or accepted as suitable for the proposed use under procedures and power of the administrative authority.

APPROVED SAFETY COVER. A manually or power-applied safety pool cover that meets all of the performance standards of ASTM International in compliance with ASTM F 1346.

APPROVED TESTING AGENCY. An organization primarily established for the purpose of testing to approved standards and approved by the administrative authority.

BACKWASH PIPING. See "Filter waste discharge piping."

BARRIER. A fence, dwelling wall or nondwelling wall or any combination thereof which completely surrounds the swimming pool and obstructs access to the swimming pool, especially access from the residence or from the yard outside the barrier.

BODY FEED. Filter aid fed into a diatomite-type filter throughout the filtering cycle.

CARTRIDGE FILTER. A filter using cartridge type filter elements.

CHEMICAL PIPING. Piping which conveys concentrated chemical solutions from a feeding apparatus to the circulation piping.

CIRCULATION PIPING SYSTEM. Piping between the pool structure and the mechanical equipment. Usually includes suction piping, face piping and return piping.

COMBINATION VALVE. A multipart valve intended to perform more than one function.

DESIGN HEAD. Total head requirement of the circulation system at the design rate of flow.

DIATOIMTE (DIATOAMCEOUS EARTH). A type of filter aid.

DIATOIMTE TYPE FILTER. A filter designed to be used with filter aid.

DIRECT ACCESS FROM THE HOME. Any opening which discharges into the "perimeter" of the pool or any opening in an exterior dwelling wall, or interior wall (for indoor pools) which faces the pool.

EXIT ALARM. A device that makes audible, continuous alarm sounds when any door or window which permits access from the residence to any pool that is without an intervening enclosure is opened or left ajar.

FACE PIPING. Piping, with all valves and fittings, which is used to connect the filter system together as a unit.

FILTER. Any apparatus by which water is clarified.

FILTER AID. A nonpermanent type of filter medium or aid such as diatomite, alum, etc.

FILTER CARTRIDGE. A disposable or renewable filter element which generally employs no filter aid.

FILTER ELEMENT. That part of a filter which retains the filter medium.

FILTER MEDIUM. Fine material which entraps the suspended particles and removes them from the water.

FILTER RATE. Average rate of flow per square foot of filter area.

FILTER ROCK. Specially graded rock and gravel used to support filter sand.

FILTER SAND. A specially graded type of permanent filter medium.

FILTER SEPTUM. That part of the filter element in a diatomite type filter upon which a cake of diatomite or other nonpermanent filter aid may be deposited.

FILTER WASTE DISCHARGE PIPING. Piping that conducts waste water from a filter to a drainage system. Connection to drainage system is made through an air gap or other approved methods.

FRESH WATER. Those waters having a specific conductivity less than a solution containing 6,000 ppm of sodium chloride.

HIGH RATE SAND FILTER. A sand filter designed for flows in excess of 5 gpm (.3 L/s) per square foot.

HOT TUB. See "Swimming pool."

INGROUND POOL. See "Swimming pool."

INLET FITTING. Fitting or fixture through which circulated water enters the pool.

MAIN SUCTION OUTLET. Outlet at the deep portion of the pool through which the main flow of water leaves the pool when being drained or circulated.

MESH SAFETY BARRIER. A combination of materials, including fabric, posts, and other hardware to form a barrier around a swimming pool.

MEDICALLY FRAIL ELDERLY PERSON. Means any person who is at least 65 years of age and has a medical problem that affects balance, vision, or judgment, including but not limited to a heart condition, diabetes, or Alzheimer's disease or any related disorder.

POOL. See "Swimming pool."

POOL DEPTHS. The distance between the floor of pool and the maximum operating water level.

POOL PERIMETER. A pool perimeter is defined by the limits of the pool deck, its surrounding area including yard area on same property, and any dwelling or nondwelling wall or any combination thereof which completely surrounds the pool.

POOL PLUMBING. All chemical, circulation, filter waste discharge piping, deck drainage and water filling system.

PORTABLE POOL. A prefabricated pool which may be erected at the point of intended use and which may be subsequently disassembled and reerected at a new location. Generally installed on the surface of the ground and without excavation.

PRECOAT. In a diatomite-type filter, the initial coating or filter aid placed on the filter septum at the start of the filter cycle.

RAPID SAND FILTER. A filter designed to be used with sand as the filter medium and for flows not to exceed 5 gpm (.3 L/s) per square foot.

RECEPTOR. An approved plumbing fixture or device of such material, shape and capacity as to adequately receive the discharge from indirect waste piping, so constructed and located as to be readily cleaned.

RESIDENTIAL. Situated on the premises of a detached one- or two-family dwelling or a one-family townhouse not more than three stories high.

RETURN PIPING. That portion of the circulation piping which extends from the outlet side of the filters to the pool.

SALINE WATER. Those waters having a specific conductivity in excess of a solution containing 6,000 ppm of sodium chloride.

SEPARATION TANK. A device used to clarify filter rinse or waste water; sometimes called a "reclamation tank."

SKIM FILTER. A surface skimmer combined with a vacuum diatomite filter.

SPA, NONPORTABLE. See "Swimming pool."

SPA, PORTABLE. Nonpermanent structure intended for recreational bathing, in which all controls and water heating and water circulating equipment are an integral part of the product and which is cord-connected and not permanently electrically wired.

SUCTION PIPING. That portion of the circulation piping located between the pool structure and the inlet side of the pump and usually includes main outlet piping, skimmer piping, vacuum piping and surge tank piping.

SURFACE SKIMMER. A device generally located in the pool wall which skims the pool surface by drawing pool water over a self-adjusting weir.

SWIMMING POOL, PRIVATE. Any structure, located in a residential area, that is intended for swimming or recreational bathing and contains water over 24 inches (610 mm) deep including but not limited to inground, aboveground, and onground swimming pools, hot tubs, and nonportable spas.

SWIMMING POOL, INDOOR. A swimming pool which is totally contained within a structure and surrounded on all four sides by walls of said structure.

SWIMMING POOL, OUTDOOR. Any swimming pool which is not an indoor pool.

SWIMMING POOL, PUBLIC. A watertight structure of concrete, masonry, fiberglass, stainless steel or plastic which is located either indoors or outdoors, used for bathing or swimming by humans, and filled with a filtered and disinfected water supply, together with buildings, appurtenances and equipment used in connection therewith. A public swimming pool or public pool shall mean a conventional pool, spa-type pool, wading pool, special purpose pool or water recreation attraction, to which admission may be

gained with or without payment of a fee and includes, pools operated by or serving camps, churches, cities, counties, day care centers, group home facilities for eight or more clients, health spas, institutions, parks, state agencies, schools, subdivisions; or the cooperative living-type projects of five or more living units, such as apartments, boarding houses, hotels, mobile home parks, motels, recreational vehicle parks and townhouses.

SWIMMING POOL, RESIDENTIAL. See "Swimming pool, private."

TURNOVER TIME. The time in hours required for the circulation system to filter and recirculate a volume of water equal to the pool volume.

VACUUM FITTING. A fitting in the pool which is used as a convenient outlet for connecting the underwater suction cleaning equipment.

VACUUM PIPING. The piping from the suction side of a pump connected to a vacuum fitting located at the pool and below the water level.

WASTE PIPING. See "Filter waste discharge piping."

WIDTH AND/OR LENGTH. Actual water dimension taken from wall to wall at the maximum operating water level.

YOUNG CHILD. Any person under the age of 6 years.

424.2.3 Mechanical requirements. Unless otherwise specified in this code, all piping, equipment and materials used in the process piping system of swimming pools that are built in place shall conform to the *Florida Building Code, Plumbing*.

424.2.4 Approvals.

424.2.4.1 Compliance. All materials, piping, valves, equipment or appliances entering into the construction of swimming pools or portions thereof shall be of a type complying with this code or of a type recommended and approved by a nationally recognized testing agency or conforming to other recognized standards acceptable to the administrative authority.

424.2.4.2 Items not covered. For any items not specifically covered in these requirements, the administrative authority is hereby authorized to require that all equipment, materials, methods of construction and design features shall be proven to function adequately, effectively and without excessive maintenance and operational difficulties.

424.2.4.3 Applicant responsibility. It shall be the responsibility of the applicant to provide such data, tests or other adequate proof that the device, material or product will satisfactorily perform the function for which it is intended, before such item shall be approved or accepted for tests.

424.2.5 Alternate materials and methods of construction.

424.2.5.1 Approval and authorization. The provisions of this code are not intended to prevent the use of any alternate material, method of construction, appliance or equipment, provided any such alternate has been first approved and its use authorized by the administrative authority.

424.2.5.2 Required tests. When there is insufficient evidence to substantiate claims for alternates, the administrative authority may require tests, as proof of compliance, to be made by an approved agency at the expense of the applicant.

424.2.6 Private swimming pools.

424.2.6.1 Conformance standard. Design, construction and workmanship shall be in conformity with the requirements of ANSI/NSPI 3, ANSI/NSPI 4, ANSI/NSPI 5, ANSI/NSPI 6, and ANSI/APSP 7.

424.2.6.2 Required equipment. Every swimming pool shall be equipped complete with approved mechanical equipment consisting of filter, pump, piping valves and component parts.

Exception: Pools with a supply of fresh water equivalent to the volume of the pool in the specified turnover time will be allowed.

424.2.6.3 Water velocity. Pool piping shall be designed so the water velocity will not exceed 10 feet per second (mm/s) for pressure piping and 8 feet per second (mm/s) for suction piping, except that the water velocity shall not exceed 8 feet per second (3048 mm/s) in copper tubing. Main suction outlet velocity must comply with ANSI/APSP 7.

Exception: Jet inlet fittings shall not be deemed subject to this requirement.

424.2.6.4 Piping to heater. Water flow through the heater, any bypass plumbing installed, any back-siphoning protection, and the use of heat sinks shall be done in accordance with the manufacturer's recommendations.

424.2.6.5 Piping installation. All piping materials shall be installed in strict accordance with the manufacturer's installation standards.

Exception: Primer and glue on exposed above-ground piping not required to be colored.

424.2.6.6 Entrapment protection for suction outlets shall be installed in accordance with requirements of ANSI/APSP 7.

424.2.7 Pumps.

424.2.7.1 Strainer. Pool circulating pumps shall be equipped on the inlet side with an approved type hair and lint strainer when used with a pressure filter.

424.2.7.2 Installation. Pumps shall be installed in accordance with manufacturer recommendations.

424.2.7.3 Capacity. Pumps shall have design capacity at the following heads.

1. Pressure diatomaceous earth–At least 60 feet (18 288 mm).
2. Vacuum D.E.–20-inch (508 mm) vacuum on the suction side and 40 feet (1219 mm) total head.
3. Rapid sand–At least 45 feet (13 716 mm).

4. High rate sand–At least 60 feet (18 288 mm).

424.2.7.4 Materials. Pump impellers, shafts, wear rings and other working parts shall be of corrosion-resistant materials.

424.2.8 Valves.

424.2.8.1 General. Valves shall be made of materials that are approved in the *Florida Building Code, Plumbing*. Valves located under concrete slabs shall be set in a pit having a least dimension of five pipe diams with a minimum of at least 10 inches (254 mm) and fitted with a suitable cover. All valves shall be located where they will be readily accessible for maintenance and removal.

424.2.8.2 Full-way (gate) valves. Full-way valves shall be installed to insure proper functioning of the filtration and piping system. When the pump is located below the overflow rim of the pool, a valve shall be installed on the discharge outlet and the suction line.

424.2.8.3 Check valves. Where check valves are installed they shall be of the swing, spring or vertical check patterns.

424.2.8.4 Combination valves. Combination valves shall be installed per the manufacturer's installation instructions.

424.2.9 Water supply. Unless an approved type of filling system is installed, any water supply which in the judgment of the administrative authority may be used to fill the pool, shall be equipped with backflow protection. No over the rim fill spout shall be accepted unless located under a diving board, or properly guarded.

424.2.10 Waste water disposal.

424.2.10.1 Connection limitations. Direct or indirect connections shall not be made between any storm drain, sewer, drainage system, seepage pit underground leaching pit, or subsoil drainage line, and any line connected to a swimming pool unless approved by the administrative authority.

424.2.10.2 Disposal through public sewer. When the waste water from a swimming pool is to be disposed of through a public sewer, a 3-inch (76 mm) P-trap shall be installed on the lower terminus of the building drain and the tall piece from the trap shall extend a minimum of 3 inches (76 mm) above finished grade and below finished floor grade. This trap need not be vented. The connection between the filter waste discharge piping and the P-trap shall be made by means of an indirect connection.

424.2.10.3 Deviations. Plans and specifications for any deviation from the above manner of installation shall first be approved by the administrative authority before any portion of any such system is installed. When waste water disposal is to seepage pit installation, it shall be installed in accordance with the approval granted by the administrative authority.

424.2.11 Separation tank. A separation tank of an approved type may be used in lieu of the aforementioned means of waste water disposal when connected as a reclamation system.

424.2.12 Tests.

424.2.12.1 Pressure test. All pool piping shall be tested and proved tight to the satisfaction of the administrative authority, under a static water or air pressure test of not less than 35 psi (241 kPa) for 15 minutes.

Exception: Circulating pumps need not be tested as required in this section.

424.2.12.2 Drain and waste piping. All drain and waste piping shall be tested by filling with water to the point of overflow and all joints shall be tight.

424.2.13 Drain piping.

424.2.13.1 Slope to discharge. Drain piping serving gravity overflow gutter drains and deck drains shall be installed to provide continuous grade to point of discharge.

424.2.13.2 Joints and connections. Joints and connections shall be made as required by the *Florida Building Code, Plumbing*.

424.2.14 Water heating equipment.

424.2.14.1 Labels. Swimming pool water heating equipment shall conform to the design, construction and installation requirements in accordance with accepted engineering practices and shall bear the label of a recognized testing agency, and shall include a consideration of combustion air, venting and gas supply requirements for water heaters.

424.2.14.2 Water retention. If a heater is not equipped or designed for an approved permanent bypass or antisiphon device, an approved permanent bypass or antisiphon device shall be installed to provide a positive means of retaining water in the heater when the pump is not in operation.

424.2.14.3 Pit drainage. When the heater is installed in a pit, the pit shall be provided with approved drainage facilities.

424.2.14.4 Connections. All water heating equipment shall be installed with flanges or union connection adjacent to the heater.

424.2.14.5 Relief valve. When water heating equipment which is installed in a closed system has a valve between the appliance and the pool, a pressure relief valve shall be installed on the discharge side of the water heating equipment. For units up to and including 200,000 Btu/hour input, the relief valve shall be rated by the American Gas Association.

424.2.15 Gas piping. Gas piping shall comply with the *Florida Building Code, Fuel Gas*.

424.2.16 Electrical. Electrical wiring and equipment shall comply with Chapter 27 of the *Florida Building Code, Building*.

424.2.17 Residential swimming barrier requirement. Residential swimming pools shall comply with Sections 424.2.17.1 through 424.2.17.3.

Exception: A swimming pool with an approved safety pool cover complying with ASTM F 1346.

424.2.17.1 Outdoor swimming pools. Outdoor swimming pools shall be provided with a barrier complying with Sections 424.2.17.1.1 through 424.2.17.1.14.

424.2.17.1.1 The top of the barrier shall be at least 48 inches (1219 mm) above grade measured on the side of the barrier which faces away from the swimming pool. The maximum vertical clearance between grade and the bottom of the barrier shall be 2 inches (51 mm) measured on the side of the barrier which faces away from the swimming pool. Where the top of the pool structure is above grade the barrier may be at ground level or mounted on top of the pool structure. Where the barrier is mounted on top of the pool structure, the maximum vertical clearance between the top of the pool structure and the bottom of the barrier shall be 4 inches (102 mm).

424.2.17.1.2 The barrier may not have any gaps, openings, indentations, protrusions, or structural components that could allow a young child to crawl under, squeeze through, or climb over the barrier as herein described below. One end of a removable child barrier shall not be removable without the aid of tools. Openings in any barrier shall not allow passage of a 4-inch diameter (102 mm) sphere.

424.2.17.1.3 Solid barriers which do not have openings shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.

424.2.17.1.4 Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the swimming pool side of the fence. Spacing between vertical members shall not exceed 1¾ inches (44 mm) in width. Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 1¾ inches (44 mm) in width.

424.2.17.1.5 Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing between vertical members shall not exceed 4 inches (102 mm). Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 1¾ inches (44 mm) in width.

424.2.17.1.6 Maximum mesh size for chain link fences shall be a 2¼ inch (57 mm) square unless the fence is provided with slats fastened at the top or bottom which reduce the openings to no more than 1¾ inches (44 mm).

424.2.17.1.7 Where the barrier is composed of diagonal members, the maximum opening formed by the diagonal members shall be no more than 1¾ inches (44 mm).

424.2.17.1.8 Access gates, when provided, shall be self-closing and shall comply with the requirements of Sections 424.2.17.1.1 through 424.2.17.1.7 and shall be equipped with a self-latching locking device located on the pool side of the gate. Where the device release is located no less than 54 inches (1372 mm) from the bottom of the gate, the device release mechanism may be located on either side of the gate and so placed that it cannot be reached by a young child over the top or through any opening or gap from the outside. Gates that provide access to the swimming pool must open outward away from the pool. The gates and barrier shall have no opening greater than $^1/_2$ inch (12.7 mm) within 18 inches (457 mm) of the release mechanism.

424.2.17.1.9 Where a wall of a dwelling serves as part of the barrier, one of the following shall apply:

1. All doors and windows providing direct access from the home to the pool shall be equipped with an exit alarm complying with UL 2017 that has a minimum sound pressure rating of 85 dB A at 10 feet (3048 mm). The exit alarm shall produce a continuous audible warning when the door and its screen are opened. The alarm shall sound immediately after the door is opened and be capable of being heard throughout the house during normal household activities. The alarm shall be equipped with a manual means to temporarily deactivate the alarm for a single opening. Such deactivation shall last no more than 15 seconds. The deactivation switch shall be located at least 54 inches (1372 mm) above the threshold of the door. Separate alarms are not required for each door or window if sensors wired to a central alarm sound when contact is broken at any opening.

   Exceptions:

   a. Screened or protected windows having a bottom sill height of 48 inches (1219 mm) or more measured from the interior finished floor at the pool access level.

   b. Windows facing the pool on floor above the first story.

   c. Screened or protected pass-through kitchen windows 42 inches (1067 mm) or higher with a counter beneath.

2. All doors providing direct access from the home to the pool must be equipped with a self-closing, self-latching device with positive mechanical latching/locking installed a minimum of 54 inches (1372 mm) above the threshold, which is approved by the authority having jurisdiction.

424.2.17.1.10 Where an above-ground pool structure is used as a barrier or where the barrier is mounted on

top of the pool structure, and the means of access is a ladder or steps, the ladder or steps either shall be capable of being secured, locked or removed to prevent access, or the ladder or steps shall be surrounded by a barrier which meets the requirements of Sections 424.2.17.1.1 through 424.2.17.1.9 and Sections 424.2.17.1.12 through 424.2.17.1.14. When the ladder or steps are secured, locked or removed, any opening created shall not allow the passage of a 4-inch-diameter (102 mm) sphere.

424.2.17.1.11 Standard screen enclosures which meet the requirements of Section 424.2.17 may be utilized as part of or all of the "barrier" and shall be considered a "nondwelling" wall. Removable child barriers shall have one end of the barrier nonremovable without the aid of tools.

424.2.17.1.12 The barrier must be placed around the perimeter of the pool and must be separate from any fence, wall, or other enclosure surrounding the yard unless the fence, wall, or other enclosure or portion thereof is situated on the perimeter of the pool, is being used as part of the barrier, and meets the barrier requirements of this section.

424.2.17.1.13 Removable child barriers must be placed sufficiently away from the water's edge to prevent a young child or medically frail elderly person who may manage to penetrate the barrier from immediately falling into the water. Sufficiently away from the water's edge shall mean no less than 20 inches (508 mm) from the barrier to the water's edge. Dwelling or nondwelling walls including screen enclosures, when used as part or all of the barrier and meeting the other barrier requirements, may be as close to the water's edge as permitted by this code.

424.2.17.1.14 A wall of a dwelling may serve as part of the barrier if it does not contain any door or window that opens to provide direct access from the home to the swimming pool.

424.2.17.1.15 A mesh safety barrier meeting the requirements of Section 424.2.17 and the following minimum requirements shall be considered a barrier as defined in this section:

1. Individual component vertical support posts shall be capable of resisting a minimum of 52 pounds (24 kg) of horizontal force prior to breakage when measured at a 36 inch (914 mm) height above grade. Vertical posts of the child safety barrier shall extend a minimum of 3 inches (76 mm) below deck level and shall be spaced no greater than 36 inches (914 mm) apart.
2. The mesh utilized in the barrier shall have a minimum tensile strength according to ASTM D 5034 of 100 lbf, and a minimum ball burst strength according to ASTM D 3787 of 150 lbf. The mesh shall not be capable of deformation such that a $^{1}/_{4}$-inch (6.4 mm) round object could not pass through the mesh. The mesh shall receive a descriptive performance rating of no less than "trace discoloration" or "slight discoloration" when tested according to ASTM G 53, *Weatherability, 1,200 hours*.
3. When using a molding strip to attach the mesh to the vertical posts, this strip shall contain, at a minimum, #8 by ½ inch (12.7 mm) screws with a minimum of two screws at the top and two at the bottom with the remaining screws spaced a maximum of 6 inches (152 mm) apart on center.
4. Patio deck sleeves (vertical post receptacles) placed inside the patio surface shall be of a nonconductive material.
5. A latching device shall attach each barrier section at a height no lower than 45 inches (1143 mm) above grade. Common latching devices that include, but are not limited to, devices that provide the security equal to or greater than that of a hook-and-eye-type latch incorporating a spring actuated retaining lever (commonly referred to as a safety gate hook).
6. The bottom of the mesh safety barrier shall not be more than 1 inch (25 mm) above the deck or installed surface (grade).

424.2.17.1.16 Adjacent waterways. Permanent natural or permanent man-made features such as bulkheads, canals, lakes, navigable waterways, etc., adjacent to a public or private swimming pool or spa may be permitted as a barrier when approved by the authority having jurisdiction. When evaluating such barrier features, the authority may perform on-site inspections and review evidence such as surveys, aerial photographs, water management agency standards and specifications, and any other similar documentation to verify, at a minimum, the following:

1. The barrier feature is not subject to natural changes, deviations, or alterations and is capable of providing an equivalent level of protection as that provided by the code.
2. The barrier feature clearly impedes, prohibits or restricts access to the swimming pool or spa.

424.2.17.2 Indoor swimming pools. All walls surrounding indoor swimming pools shall comply with Section 424.2.17.1.9.

424.2.17.3 Prohibited locations. A barrier may not be located in a way that allows any permanent structure, equipment, or window that opens to provide access from the home to the swimming pool.

424.2.18 Ladders and steps. All pools whether public or private shall be provided with a ladder or steps in the shallow end where water depth exceeds 24 inches (610 mm). In private pools where water depth exceeds 5 feet (1524 mm) there shall be ladders, stairs or underwater benches/swim-outs in the deep end. Where manufactured diving

equipment is to be used, benches or swim-outs shall be recessed or located in a corner.

Exception: In private pools having more than one shallow end, only one set of steps are required. A bench, swimout or ladder may be used at all additional shallow ends in lieu of an additional set of steps.

424.2.19 Final inspection. Final electrical, and barrier code, inspection shall be completed prior to filling the pool with water.

Exception: Vinyl liner and fiberglass pools are required to be filled with water upon installation.

424.2.20 Filters. Components shall have sufficient capacity to provide a complete turnover of pool water in 12 hours or less.

424.2.20.1 Sand filters.

424.2.20.1.1 Approved types. Rapid sand filters [flow up to 5 gpm per square foot (.3L/s)] shall be constructed in accordance with approved standards. Where high rate sand filters [flow in excess of 5 gpm per square foot (.3 L/s)] are used, they shall be of an approved type. The circulation system and backwash piping shall be adequate for proper backwashing of said filter and shall provide backwash flow rates of at least 12 gpm per square foot (.8 L/s) or rapid sand filters or 15 gpm per square foot (.9 L/s) for high rate sand filters.

424.2.20.1.2 Instructions. Every filter system shall be provided with written operating instructions.

424.2.20.1.3 Filter system equipment. On pressure-type filters, a means shall be provided to permit the release of internal pressure. A filter incorporating an automatic internal air release as its principal means of air release shall have lids which provide a slow and safe release of pressure as part of its design. A separation tank used in conjunction with a filter tank shall have as part of its design a manual means of air release or a lid which provides a slow and safe release of pressure as it is opened.

424.2.20.2 Diatomite type filters.

424.2.20.2.1 Design. Diatomite-type filters shall be designed for operation under either pressure or vacuum. The design capacity for both pressure and vacuum filters shall not exceed 2 gpm per square foot (.13 L/s) of effective filter area.

424.2.20.2.2 Filter aid. Provision shall be made to introduce filter aid into the filter in such a way as to evenly precoat the filter septum.

424.2.21 Pool fittings.

424.2.21.1 Approved type. Pool fittings shall be of an approved type and design as to be appropriate for the specific application.

424.2.21.2 Skimmers. Approved surface skimmers are required and shall be installed in strict accordance with the manufacturer's installation instructions. Skimmers shall be installed on the basis of one per 800 square feet (74 m^2) of surface area or fraction thereof, and shall be designed for a flow rate of at least 25 gpm (94L/m) per skimmer.

424.2.21.3 main outlet. An approved main outlet, when provided, shall be located on a wall or floor at or near the deepest point in the pool for emptying or circulation, or both, of the water in the pool.

424.2.21.4 Hydrostatic relief device. In areas of anticipated water table an approved hydrostatic relief device shall be installed.

Exception: Plastic liner pools (where there is no structural bottom to the pool).

424.2.21.5 Inlet fittings. Approved manufactured inlet fittings for the return of recirculated pool water shall be provided on the basis of at least one per 300 square feet (28 m^2) of surface area. Such inlet fittings shall be designed and constructed to insure an adequate seal to the pool structure and shall incorporate a convenient means of sealing for pressure testing of the pool circulation piping. Where more than one inlet is required, the shortest distance between any two required inlets shall be at least 10 feet (3048 mm).

424.2.22 Equipment foundations and enclosures. All pool motors and equipment shall be installed in compliance with the manufacturer's recommendations. All heating and electrical equipment, unless approved for outdoor installation, shall be adequately protected against the weather or installed within a building.

424.2.23 Accessibility and clearances. Equipment shall be so installed as to provide ready accessibility for cleaning, operating, maintenance and servicing.

SECTION 425
PUBLIC LODGING ESTABLISHMENTS

425.1 Scope. Public lodging establishments shall comply with the following design and construction standards.

Note: Other administrative and programmatic provisions may apply. See Department of Business and Professional Regulations (DBPR) Rules 61C-1 and 61C-3, *Florida Administrative Code* and Chapter 509, *Florida Statutes*.

425.2 Definitions.

PUBLIC LODGING ESTABLISHMENT. See Section 509.013, *Florida Statutes*.

425.3 General sanitation and safety requirements. The following general requirements and standards shall be met by all public lodging establishments:

425.3.1 Water, plumbing and waste. Except as specifically provided in this code, standards for water, plumbing and waste shall be governed by Chapter 5 of 1999 Food Code and Chapter 509 Part I, *Florida Statutes*. For the purposes of this section, the term "food establishment" as referenced in the Food Code shall apply to all public lodging establishments as defined in Chapter 509, *Florida Statutes*.

425.3.2 Public bathrooms.

425.3.2.1 Each public lodging establishment shall be provided with adequate and conveniently located bathroom facilities for its employees and guests in accordance with provisions of this section and the *Florida Building Code, Plumbing*. Public access to toilet facilities shall not be permitted through food preparation, storage, or ware washing areas. Bathroom fixtures shall be of readily cleanable sanitary design.

425.3.2.2 Public bathrooms shall be completely enclosed and shall have tight-fitting, self-closing doors or have entrances and exits constructed in such a manner as to ensure privacy of occupants. Such doors shall not be left open except during cleaning or maintenance.

425.3.2.3 Resort condominiums, nontransient establishments and resort dwellings are exempt from the provisions of this section.

425.3.3 Vermin control. Effective control measures shall be taken to protect against the entrance into the establishment, and the breeding or presence on the premises of rodents, flies, roaches and other vermin. All buildings shall be effectively rodentproofed. All windows used for ventilation must be screened, except when effective means of vermin control are used. Screening material shall not be less than 16 mesh to the inch or equivalent, tightfitting and free of breaks.

425.3.4 Fire safety. All fire safety, protection and prevention equipment must be installed, approved, maintained and used in accordance with Chapter 509, *Florida Statutes*, Chapter 69A-3 Fire Prevention–General Prevention Code, *Florida Administrative Codes*.

425.3.4.1 Specialized smoke detectors. Specialized smoke detectors for the deaf and hearing-impaired shall be made available upon request by guests in transient public lodging establishments without charge. Failure of the operator to inform any employee charged with registering guests of the location of such detector constitutes failure to make such detectors available.

425.3.5 Electrical wiring. To prevent fire or injury, defective electrical wiring shall be replaced and wiring shall be kept in good repair. Only a wall switch or approved pull cord shall be permitted in bathrooms. Electrical wiring shall be in accordance with the provisions of Chapter 27 of the *Florida Building Code, Building*.

425.3.6 Heating and ventilation. The heating and ventilation system shall be kept in good repair or be installed to maintain a minimum of 68°F (20°C) throughout the building.

425.3.7 Gas appliances. All appliances, including water heaters using gas, shall be properly vented as required by the *Florida Building Code, Fuel Gas*.

425.4 Sanitation and safety requirements.

425.4.1 Guest bathrooms.

425.4.1.1 Connecting bathrooms shall provide toilets with open-front seats. Guest and private bathrooms shall provide toilets. Guest, private, and connecting bathrooms shall provide lavatories and shower enclosures with hot and cold running water under pressure.

425.4.1.2 Each transient public lodging establishment shall maintain one public bathroom with a minimum of a toilet, lavatory, and shower enclosure for each sex on every floor for every 15 guests rooming on that floor not having access to private or connecting bathrooms.

425.4.2 Ice storage bins. Ice storage bins shall be drained through an air gap in accordance with the provisions of the *Florida Building Code, Plumbing*.

425.4.3 Locks. A locking device shall be provided in accordance with the *Florida Fire Prevention Code*. Public lodging establishments as defined in rule 61C-1.002(4)(a), *Florida Statutes*, shall have at least one approved locking device which does not include a sliding chain or hook-and-eye type device, on all outside and connecting doors which cannot be opened by a nonmaster guest room key.

SECTION 426
PUBLIC FOOD SERVICE ESTABLISHMENTS

426.1 Scope. Public food service establishments or food establishments shall comply with design and construction standards as described in the Food Code, Chapter 509 Part I or Chapter 500, *Florida Statutes*, as applicable.

Note: Other administrative and programmatic provisions may apply. See Department of Business and Professional Regulation (DBPR) Rule 61C-4, *Florida Administrative Code* Chapter 500 and Chapter 509, *Florida Statutes*.

426.2 Definitions.

PUBLIC FOOD SERVICE ESTABLISHMENTS. See Section 509.013, *Florida Statutes*.

FOOD ESTABLISHMENTS. See Section 500.03, *Florida Statutes*.

426.3 General sanitation and safety requirements. The following general requirements and standards shall be met by all food service establishments:

426.3.1 Water, plumbing, and waste. Except as specifically provided in this section, standards for water, plumbing and waste shall be governed by Chapter 5, Food Code, herein adopted by reference.

426.3.1.1 Grease interceptors shall be designed and installed in accordance with the *Florida Building Code, Plumbing*.

426.3.2 Public bathrooms.

426.3.2.1 Food service establishment shall be provided with adequate and conveniently located bathroom facilities for its employees and guests in accordance with provisions of the *Florida Building Code, Plumbing*. Public access to toilet facilities shall not be permitted through food preparation, storage, or ware washing areas. Bathroom fixtures shall be of readily cleanable sanitary design.

426.3.2.2 Public bathrooms shall be completely enclosed and shall have tight-fitting, self closing doors or, in public lodging establishments or bathrooms located outside a public food service, have entrances and

exits constructed in such a manner as to ensure privacy of occupants.

426.3.3 Vermin control. Effective control measures shall be taken to protect against the entrance into the establishment, and the breeding or presence on the premises of rodents, flies, roaches and other vermin. All buildings shall be effectively rodentproofed. All windows used for ventilation must be screened, except when effective means of vermin control are used. Screening material shall not be less than 16 mesh to the inch or equivalent, tightfitting and free of breaks.

426.3.4 Fire safety. All fire safety, protection and prevention equipment must be installed, approved, maintained and used in accordance with Chapter 509, *Florida Statutes*, Chapter 69A-55, *Uniform Fire Safety Standards for Public Food Service Establishments*, FAC, and the *Uniform Fire Safety Standards* as adopted by the State Fire Marshal.

426.3.5 Electrical wiring. To prevent fire or injury, defective electrical wiring shall be replaced and wiring shall be kept in good repair. Only a wall switch or approved pull cord shall be permitted in bathrooms. Electrical wiring shall be in accordance with the provisions of *Florida Building Code, Building*, Chapter 27.

426.3.6 Gas appliances.

426.3.6.1 All appliances, including water heaters using gas, shall be properly vented in accordance with the *Florida Building Code, Fuel Gas*. All appliances shall have a nationally recognized testing laboratory seal such as AGA or UL seal.

426.3.6.2 Heating appliances shall be properly sized in Btu input for room air space. Proper sizing of heating appliances shall be determined in accordance with the provisions of the *Florida Building Code, Fuel Gas*.

426.4 Sanitation and safety requirements.

426.4.1 Bathroom facilities. All bathrooms shall be of easy and convenient access to both patrons and employees and shall be located on the same floor of the premises served. For the purpose of this section, the same floor includes any intermediate levels between the floor and ceiling of any room or space not to exceed a vertical height of 8 feet (2438 mm). Public food service establishments whose occupancy is incidental to another occupancy may utilize public restrooms provided on the same floor. The travel distance may vary where adequate directional signs are provided and the number of fixtures is deemed satisfactory by the applicable plumbing authority. Each public food service establishment shall maintain a minimum of one public bathroom for each sex, properly designated, except as provided herein:

426.4.1.1 Places serving food or drink on a take-out, carry-out or delivery basis only which provide no seating shall be required to provide a minimum of one bathroom accessible to the public.

426.4.1.2 Arcades, malls, or flea markets containing public food service establishments which offer no seating within the public food service establishment may have centrally located bathroom facilities accessible to patrons of the establishments in the arcade, mall, or flea market provided such bathroom facilities are within 300 feet (91 440 mm) of each establishment.

426.4.1.3 Public food service establishments located within theme parks and entertainment complexes may utilize centrally located bathroom facilities accessible to patrons of the establishments in the theme park or entertainment complex provided such bathroom facilities are reasonably accessible. For purposes of this section, reasonably accessible means within 300 feet (91 440 mm) of each establishment.

426.4.1.4 Public food service establishments which seat 10 persons or less shall be required to provide a minimum of one bathroom accessible to the public.

426.4.1.5 Public food service establishments located within a public lodging establishment shall be permitted to utilize public bathrooms located within the public lodging establishment, provided such bathrooms are available for use by the patrons of the public food service establishment during all hours of operation, are within 300 feet (91 440 mm) of the public food service establishment, and are located on the same floor as the public food service establishment. For purposes of this section, the same floor includes any intermediate levels between the floor and ceiling of any room or space without restriction as to vertical height.

SECTION 427
MENTAL HEALTH PROGRAMS

427.1 Public mental health crisis stabilization units and short-term residential treatment programs.

427.1.1 Scope. Crisis stabilization units and short-term residential treatment units shall comply with the design and construction standards in this section.

Note: Other administrative and programmatic provisions may apply. See Department of Children and Family Services (DCFS) Rule 65E-12, *Florida Administrative Code*, and Chapter 394, *Florida Statutes*.

427.1.2 Definitions.

CRISIS STABILIZATION UNIT (CSU). A state-supported mental health service or program and is a short-term alternative to inpatient psychiatric hospitalization and an integrated part of a designated public receiving facility under the authority of Chapter 394, *Florida Statutes*. A CSU provides brief intensive services for individuals who are presented as acutely mentally ill on a 24-hour-a-day, seven-day-a-week basis, under the licensing authority of the department of Children and Families and the Agency for Health Care Administration. The purpose of a CSU is emergency psychiatric reception, psychiatric examination, to stabilize and redirect people to the most appropriate and least restrictive treatment settings consistent with their needs.

SHORT-TERM RESIDENTIAL TREATMENT PROGRAM (SRT). A state-supported acute care 24-hour-a-day, seven-day-a-week residential alternative service, generally of 90 days or less, and which is an integrated part of a designated public receiving facility and receives state mental

health funds under the authority of chapter 394, F.S. The purpose of an SRT is to provide less acute intensive short-term treatment to individuals who have previously been admitted to either a hospital or CSU and have been transferred to the SRT as being temporarily in need of a 24-hour-a-day structured therapeutic setting in a less restrictive, but longer-stay alternative to hospitalization.

427.1.3 Facility standards for facilities licensed prior to or on July 14, 1993.

427.1.3.1 Building construction requirements.

427.1.3.1.1 Construction, additions, refurbishing, renovations, and alterations to existing facilities shall comply with the following codes and standards:

1. The building codes described in the *Florida Building Code*;
2. The fire codes contained in Chapter 69A-44, "Minimum Fire Safety Standards for Residential Alcohol and Drug Abuse Treatment and Prevention Programs, Mental Health Residential Treatment Facilities and Crisis Stabilization Units," *Florida Administrative Code,* as described in the NFPA 101, Chapters 18 and 19, Special Definitions, as adopted by the *Florida Fire Prevention Code*, as applicable to limited health care facilities, which is included by reference in Chapter 59A-3, *Florida Administrative Code.*

427.1.3.2 Minimum physical plant requirements. Each CSU and SRT shall conform to the requirements of Sections 427.1.3.2.1 through 427.1.3.2.12.

427.1.3.2.1 In multiple occupancy bedrooms or sleeping areas there shall be a minimum of 60 square feet (6 m^2) per bed and no less than a 30-inch (762 mm) separation between beds. Bedrooms shall be limited to a maximum of four occupants.

427.1.3.2.2 The minimum size of a single occupant bedroom shall be 55 square feet (5 m^2).

427.1.3.2.3 Each CSU shall have at least one seclusion room and another room which may be used as a seclusion room. Each SRT shall have a seclusion room. Seclusion rooms shall be a minimum of 55 square feet (5 m^2). If a restraint bed is utilized it shall have access around it and be bolted to the floor. Seclusion rooms shall minimally include a mattress. Ceilings shall be solid, and all lighting fixtures shall be tamperproof, and power receptacles are not permitted in the room.

427.1.3.2.4 The facility shall have at least one water fountain readily accessible for the use of persons receiving services.

427.1.3.2.5 The facility shall have a minimum ratio of one shower for each eight individuals and one toilet and lavatory for each six individuals. Individual shower stalls and dressing areas shall be provided. The use of gang showers is prohibited. Access to a bathroom shall not be through another person's room.

427.1.3.2.6 The facility shall have a locked area for personal possessions being held for safekeeping. Individual shelves or other similar dividers shall be provided in the locked area for the storage of personal possessions. The facility shall have written policies and procedures to ensure reasonable access to personal possessions.

427.1.3.2.7 Each facility shall have a fenced outside recreation area with a minimum fence height of no less than 6 feet (1829 mm) suitable for impeding elopements.

427.1.3.2.8 External windows shall have security screens or equivalent protection.

427.1.3.2.9 The facility shall provide an appropriate separate nontreatment area to serve as a general reception area with accommodations for such activities as receiving visitors. This reception area shall be separated from the treatment area by a locked doorway.

427.1.3.2.10 When a CSU is collocated with another program, as provided for in Section 65E-12.106(23), *Florida Administrative Code*, the following minimum facility requirements shall be met.

Collocation means the operation of CSU and SRT, or CSU and substance abuse detoxification services from a common nurses' station without treatment system integration. It may result in the administration of those services by the same organization and the sharing of common services, such as housekeeping, maintenance and professional services.

1. A CSU shall be separated and secured by locked doors, used by persons receiving services, from the SRT and detoxification units.
2. Whenever a CSU is collocated with an SRT or substance abuse detoxification unit there shall be no compromise in CSU standards. In all instances, whenever there is a conflict between CSU rules and SRT, alcohol or drug abuse rules, the more restrictive rules shall apply.

427.1.3.2.11 All CSUs shall be locked facilities and, to the maximum extent practical, provide a locked perimeter around a living unit and fenced exercise area within which individuals can reside 24 hours-a-day in an environment designed to minimize potential for injury. Where this is not possible, operational compensation shall be made as follows:

1. Each person receiving services shall be provided a minimum of 175 square feet (16 m^2) of usable client space within the CSU. Useable client space is the sum, in gross square feet, of all rooms, interior wall to interior wall, that are part of a CSU and SRT facility. mechanical and electrical rooms, administrative and staff offices, screening areas, nurses' stations, visitor and reception areas, crawl space and attic space are excluded. Bedrooms shall be spacious and attractive, and activity rooms or space shall be provided.
2. CSU facilities shall be locked to provide reasonable control over access to and egress from

the unit, recreational area, and emergency reception areas. When individuals are moved to other areas, the pathways shall also be locked or have adequate control provisions to prevent elopement. Such controlled passageways shall include access to the emergency reception area, unit proper, off unit doorways, and recreational areas.

3. All unit door locks shall employ a common key for rapid access in emergency situations with quick releasing or single-turn mechanisms.

427.1.3.2.12 Food preparation areas for 13 or more persons shall comply with the provisions of Chapter 64E-11, *Florida Administrative Code,* "Food Hygiene."

427.1.3.3 Health and sanitation.

427.1.3.3.1 Appropriate health and sanitation inspections shall be obtained before occupying any new physical facility or addition. A report of the most recent inspections must be on file and accessible to authorized individuals.

427.1.3.3.2 Hot and cold running water under pressure shall be readily available in all washing, bathing and food preparation areas. Hot water in areas used by persons being served shall be at least 100°F (38°C) but not exceed 120°F (49°C).

427.1.3.4 Seclusion room. Each CSU shall have at least one seclusion room located in the CSU facility. Additional space shall be available that can be used either as a seclusion room or bedroom, as need dictates. Policies and procedures shall be developed on handling emergency situations that require seclusion. Each SRT shall have a seclusion room.

427.1.4 Minimum construction standards for CSU and SRT facilities initially licensed after July 14, 1993.

427.1.4.1 Construction requirements.

427.1.4.1.1 New facility construction. New facility construction and additions, refurbishing, renovations and alterations to existing facilities shall comply with the following codes and standards:

1. The building codes described in the *Florida Building Code.*
2. The fire codes contained in Chapter 69A-44, "Minimum Fire Safety Standards for Residential Alcohol and Drug Abuse Treatment and Prevention Programs, Mental Health Residential Treatment Facilities and Crisis Stabilization Units," *Florida Administrative Code,* as described in the NFPA 101, Chapters 12 and 13, "Special Definitions," as adopted by the *Florida Fire Prevention Code,* as applicable to limited health care facilities, which is included by reference in Chapter 59A-3, *Florida Administrative Code.*
3. The accessibility requirements of Chapter 11 of the *Florida Building Code, Building.*

427.1.4.1.2 Plumbing. All plumbing shall comply with the requirements of the *Florida Building Code, Plumbing.*

427.1.4.1.3 Inspections and certificate of occupancy. Appropriate health and sanitation inspections and a certificate of occupancy shall be obtained before occupying any new facility or addition. A report of the most recent inspections must be on file and accessible to authorized individuals.

427.1.4.1.4 Sprinklers. No unsprinklered building classification as defined in the *Florida Building Code, Building,* is allowed. All facilities shall be protected throughout by an approved automatic sprinkler and smoke detection system to include a smoke detector in every bedroom. Provision shall be made for automatic emergency forces notification.

427.1.4.1.5 Surge protection. Surge protection in compliance with the *National Electric Code,* Article 280, as incorporated by reference in Chapter 27 of the *Florida Building Code, Building,* shall be installed to protect each service entrance equipment and have integral visual indication of surge protector failure. Additional surge protection shall be provided for all low-voltage and power connections to all electronic equipment and conductors entering or exiting the building and other life safety systems equipment such as fire alarm, telephone, and nurse call. Protection shall be in accordance with appropriate IEEE standards for the type of equipment being protected.

427.1.4.2 Overall functional design.

427.1.4.2.1 The CSU or SRT shall be designed to provide a locked perimeter around a living unit and fenced exercise area within which individuals can reside 24 hours a day in an environment designed to minimize potential for injury. The CSU or SRT structure shall be single story ground level facility. These facilities shall have separate off-unit reception and administration areas which may also be locked. Service corridors and pathways to other nonunit activities shall not be through the locked CSU or SRT unit.

427.1.4.2.2 The walls throughout all client areas of the CSU or SRT shall either be concrete block or a double layer of gypsum wallboard or ¾-inch (19 mm) thick plaster on metal lath to minimize maintenance of the facility. The general architecture of the unit shall provide for optimal line-of-sight observation from the nurses' station throughout the unit, minimizing hidden spots and blind corners.

427.1.4.2.3 The CSU or SRT shall be designed to create a pleasant functional therapeutic environment throughout, by the use of sunlight, colors, designs, textures, and furnishings. The design shall achieve a secure unit which looks more residential than institutional in its construction and furnishings, while incorporating substantial safety considerations throughout.

427.1.4.2.4 The CSU or SRT shall be designed in order that the general unit be divided into a close observation

area and a general observation area based upon the need for frequent physical proximity, singular observation of individuals, and lowered stimulation levels. These areas do not need physical separation; for example, they may be the left and right sides of the unit.

427.1.4.2.4.1 Close observation area. This area shall include persons brought onto the CSU or SRT needing initial observation or restraints, individualized observation, and lowered stimulation levels, all of which require the frequent physical proximity of nurses. This area shall be directly adjacent to the primary unit doorway and nurses' station. The immediately adjacent rooms shall be used for single occupancy and restraint or seclusion. These rooms shall be remote from routine high activity areas and corridors.

427.1.4.2.4.2 General observation area. This shall include areas where persons routinely congregate or walk through such as multioccupant bedrooms, activity rooms, smoking areas, dining room and routine traffic corridors, or pathways. The dining and activity areas shall be directly observable, or under constant staff supervision, but may be a greater distance from the nurses' station.

427.1.4.2.5 All areas of CSUs and SRTs shall be ventilated by central, ducted supply and return forced air systems. Toilets, bathrooms and soiled function rooms shall be mechanically exhausted to the outside. Ventilation units shall distribute tempered heated or cooled air to all spaces and shall supply outside air in the quantity of either the sum of all exhausts or 20 cfm (.009 m^3/s) per person whichever is greater. The quality of all exhausts must match the intake volume of all outside air. Supply, exhaust, and return fans shall run continuously while the building is occupied. Areas in which smoking is permitted shall be well vented by at least 35 cfm (.02 m^3/s) per person to the outside in order to minimize smoke diffusion throughout the unit.

427.1.4.2.6 All doors opening directly onto the unit from nonclient rooms or office areas shall be equipped with locksets which are key released to leave the client area and permit unobstructed return to the client area. Door closures are required to deny persons receiving services accidental unsupervised access to the contents of staff offices, janitorial closets, and mechanical areas.

427.1.4.2.7 Corridors shall ensure maximum clear distances by recessing water fountains and fire extinguishers, or placing them in alcoves. Corridors in client areas must be at least a 6 foot (1829 mm) clear width; nonclient areas must be at least 44 inches (1118 mm) minimum clear width. Corridor ceilings shall be a minimum height of 7 feet 6 inches (2284 mm).

427.1.4.2.8 Hot and cold running water under pressure shall be readily available in all washing, bathing, food preparation, and food handling areas. Hot water in client areas shall be at least 100°F (38°C), but not exceed 120°F (49°C).

427.1.4.2.9 The minimum size for doors shall be no less than 3 feet (914 mm) wide and 6 feet 8 inches high (2032 mm). Areas accessible to persons with physical disabilities shall comply with applicable codes and standards.

427.1.4.2.10 Since glass fragments are a safety hazard throughout the unit, the use of glass shall be minimal.

427.1.4.2.11 All television sets must be securely fastened.

427.1.4.2.12 Door closures shall not be utilized in unobserved client areas.

427.1.4.2.13 All CSUs and SRTs equipped with electronic locks on internal doors or egress doors shall ensure that such locks have manual common key mechanical override that will operate in the event of a power failure or fire. Egress pathways and doors shall be locked as provided for in the *Life Safety Code*, NFPA 101, Chapter 12, as incorporated by reference in Chapter 59A-3, *Florida Administrative Code* as adopted by the *Florida Fire Prevention Code*,

427.1.4.2.14 CSUs and SRTs with electronic or magnetic door locks or other fundamental operational components which are electric shall have either: a battery back-up system rated for facility emergency power draw and capable of sustaining door locks and emergency operations for a minimum period of 6 hours; or an emergency generator with transfer switch with a battery pack back-up system capable of operating for 2 hours at facility emergency power draw level.

427.1.4.2.15 The use of door vision panels and windows shall minimize the opportunity for isolation of staff or persons served in unobserved areas. This does not include privacy provisions such as bathrooms and bedrooms.

427.1.4.3 Uniform specifications.

427.1.4.3.1 The design shall ensure that each person receiving services in a CSU or SRT is provided a minimum of 175 square feet (16 m^2) of usable client space.

427.1.4.3.2 Tamper-resistant screws shall be used to protect electrical switches and outlets throughout the facility in all areas accessible to persons receiving services. Lighting fixtures shall be tamperproof type throughout the facility in all areas accessible to persons receiving services.

427.1.4.3.3 All electrical switches and outlets in wet areas shall be ground-fault protected with a remote breaker switch. Tamperproof, safety type duplex outlets shall be used in all areas accessible to persons receiving services.

427.1.4.3.4 Air ducts shall be covered with a perforated type metal grille not residential louvered grilles, throughout the unit in all areas accessible to persons receiving services.

427.1.4.3.5 All hose bibbs shall be equipped with a vacuum breaker device.

427.1.4.3.6 The unit shall have a minimum of one drinking fountain.

427.1.4.3.7 Ceiling height in bedrooms, activity areas, and bathrooms shall be at least 9 feet (2743 mm).

427.1.4.3.8 The operation of all perimeter locks shall ensure reasonable control over both access and egress.

427.1.4.4 Administration and public areas.

427.1.4.4.1 Waiting rooms shall have an adjacent rest room which is designed to accommodate persons with physical disabilities in accordance with Chapter 11 of the *Florida Building Code, Building*.

427.1.4.4.2 The entrance shall be grade level, sheltered from inclement weather and accessible to persons with physical disabilities in accordance with Chapter 11 of the *Florida Building Code, Building*.

427.1.4.4.3 The lobby shall include a drinking fountain and space for clerical personnel. Private interview space for emergency screening of voluntary persons shall be adjacent to the lobby.

427.1.4.5 Emergency screening area for CSUs.

427.1.4.5.1 This shall be a locked area in which law enforcement admissions may be received. This area shall not be wholly isolated visually from the CSU to provide safety for emergency screening personnel who may become isolated in this area. This area shall provide for medical clearance, emergency screening, bathroom facilities, and other activities which may be necessary.

427.1.4.5.2 A separate entrance shall be provided directly to emergency screening areas and examination rooms for law enforcement personnel. It shall have a driveway where a law enforcement vehicle can pull immediately adjacent to the building before transferring a person through the separate entrance to the emergency screening area. The law enforcement entrance shall also have a lock box where the law enforcement officer can lock his weapons during such time as he or she is in the facility.

427.1.4.5.3 A separate bathroom with supervised shower area shall be located so that all persons being admitted may be showered before being admitted to the residential section of the unit.

427.1.4.6 Seclusion rooms.

427.1.4.6.1 Each CSU shall have a minimum of two seclusion rooms that shall share a common vestibule with a bathroom off the vestibule area. Each SRT shall have at least one seclusion room. Seclusion rooms shall be free of sharp edges or corners and be strongly constructed to withstand repeated physical assaults. Walls shall be either concrete block or double layered to provide resistance and be smooth. The ceilings shall be 9 feet (2743 mm) in clear height, hard-coated, and lighting fixtures recessed and tamperproof. Lighting fixtures shall be nonbreakable, preferably Lexan, and shall be installed with tamperproof screws, as shall any other items in the seclusion rooms. The seclusion room door shall be heavy wood or metal at least 36 inches (914 mm) in width and shall open outward. The door frame shall be heavy steel and shall be thoroughly bolted into the wall and cemented in.

427.1.4.6.2 At least one seclusion room in the CSU shall have a sturdily constructed bed, without sharp edges and bolted to the floor. A bed in the SRT seclusion room is optional; however, if present, the bed shall meet the same requirements as specified for the CSU. Its placement in the room shall provide adequate space for staff to apply restraints and not assist individuals in tampering with the lights, smoke detectors, cameras, or other items that may be in the ceiling of the room. There shall be a rheostat control mechanism outside the room to adjust the illumination of the light in the seclusion room.

427.1.4.6.3 The floor and walls, up to a height of 3 feet (914 mm), shall be coated with an impermeable finish to resist penetration of body fluids. One seclusion room shall have a floor drain. A hose bibb shall be in a readily adjacent area such as a bathroom.

427.1.4.6.4 There shall be a vision panel in the door of the seclusion room, no larger than 8 inches by 8 inches (203 mm by 203 mm), which provides a view of the entire room. This vision panel shall be Lexan or other suitably strong material and it shall be securely mounted in the door. Provisions shall be made to ensure privacy from the public and other persons receiving services while providing easy access for staff observation.

427.1.4.6.5 Seclusion rooms shall be a minimum of 70 square feet (7 m^2) and a minimum room dimension of 9 feet (2743 mm).

427.1.4.6.6 Fire sprinkler heads shall be ceiling mounted and either recessed or flush-mounted type without a looped spray dispersal head.

427.1.4.6.7 A voice-activated and switchable emergency calling system for monitoring persons receiving services shall be provided in each seclusion room.

427.1.4.6.8 Each seclusion room shall have an electronic visual monitoring system capable of viewing the entire room and be monitored from the nurses' station.

427.1.4.7 Janitor's closet.

427.1.4.7.1 A janitor's closet shall be on the unit. It shall contain a floor receptor for mop water and provide space for mop bucket, brooms, and other minimal items. Caustic and other dangerous chemicals shall not be stored in this closet.

427.1.4.7.2 This closet shall have an automatic door closer and have automatic relocking type lock.

427.1.4.8 Bathrooms.

427.1.4.8.1 Access to a bathroom shall not be through another person's bedroom. Bathrooms shall provide space, in addition to bathing, for dry clothes and changing of clothes and for observation staff. The shower head shall be recessed or have a smooth curve from which items cannot be hung. There shall be no overhead rod, privacy stall supports, protrusions, or fixtures capable of carrying more than 40 pounds (18 kg) of weight. The ceiling shall be hard coated. Sprinkler heads shall be either recessed or a flush-mounted type dispersal head. The toilet shall be a flushometer-type, not residential with water tank and cover. Toilets shall be of heavy duty construction securely fastened to the floor and have seats with locking nuts. Secure cleanout access shall be provided for the toilet to clean out plugs and pipes. Floor drains in bathroom areas shall be of sufficient size that they cannot be plugged by standing on them.

427.1.4.8.2 Mirrors shall not be common glass. A polycarbonate mirror, fully secured, and flat-mounted to the wall is required. Polished metal mirrors shall not be permitted.

427.1.4.8.3 Lighting fixtures shall be recessed and tamperproof with Lexan or other strong translucent material.

427.1.4.8.4 Bathroom fixtures, shower, lavatory, and toilet shall be readily accessible from a common area. If not accessible from a common area, they will be deemed to be available only to the occupants of directly adjoining bedroom or bedrooms.

427.1.4.8.5 Each CSU and SRT shall have a bathroom of sufficient size for use by persons with physical disabilities. It shall include toilet, lavatory, shower, and safety grab bars for shower and toilet.

427.1.4.8.6 The facility shall have a minimum ratio of one shower for each eight persons receiving services and one toilet and lavatory for each six persons receiving services. Individual shower stalls and dressing areas shall be provided. The use of gang showers is prohibited.

427.1.4.9 Nurses' station.

427.1.4.9.1 The nurses' station shall be positioned so that the unit may be under constant direct visual surveillance. Charting and records areas shall be located in the rear of the nurses' station, and not in a separate area, so that staff on duty can readily observe the client areas. A bathroom shall be nearby for staff use. The nurses' station, if separated from client areas, shall utilize either Lexan or safety wire glass for enclosure to above counter top level. If not enclosed the counter top shall be at least 18 inches (457 mm) in width.

427.1.4.9.2 Thirty is the maximum number of beds which may be served by a common nurses' station in colocated units, as described in Section 65E-12.106(23), F.A.C.

427.1.4.9.3 The nurses' station, which functions as the primary control center, shall have necessary electronic assistance such as camera monitors and intercoms in more remote areas where persons may become isolated. Areas warranting visual and auditory monitoring include remote entrance or egress doors, isolated hallways, after hours law enforcement entrance, emergency screening area, and fenced recreational yard.

427.1.4.10 Medication room. The medication room shall be located near the nurses' station. The medication room shall have a sink, refrigerator, locked storage, and facilities for dispensing medication. Security against unauthorized access shall be assured. The refrigerator shall store medications and clean materials only.

427.1.4.11 Examination room. A suitable examination room shall be provided for physical examinations, nursing assessments, and other related medical activities. It shall include a sink for hand washing.

427.1.4.12 Bedrooms.

427.1.4.12.1 Ceilings shall be nonaccessible to prohibit persons receiving services from entering attic spaces or having access to overhead pipes and beams. Light switches and electrical outlets shall be secured with nontamper type screws. When feasible each bedroom shall have a window, operable by staff, with an exterior view. Window sills shall not exceed a height of 36 inches (914 mm) above floor level and should incorporate protective screens or Lexan-type material to prevent direct access to glass surfaces. There should be no overhead protrusions available for hanging in excess of 40 pounds (18 kg) weight.

427.1.4.12.2 Beds and other heavy furniture suitable for barricading the door shall be secured to the floor or walls.

427.1.4.12.3 multiple occupant bedrooms shall be limited to a maximum of four occupants and shall be a minimum size of 60 square feet (6 m^2) per bed with no less than a 30-inch (762 mm) separation between beds. Single occupant bedrooms shall be a minimum of 80 square feet (7 m^2).

427.1.4.12.4 Bedroom doors shall be a minimum of 36 inches wide.

427.1.4.13 Kitchen and nourishment preparation area.

427.1.4.13.1 Preparation or food handling areas shall have water and plumbing fixtures suitable for cleaning dining utensils. The requirements for nourishment preparation areas are less than that of kitchens due to the minimal scale of operations for these areas. If these areas are accessible to persons receiving services, they should include appropriate safety considerations for sharp and other dangerous instruments and the elimination of hot surfaces. Space shall be provided for disposal of wet garbage. Refrigeration and freezer space shall be provided in these areas for the carryover of a minimum amount of perishable food.

427.1.4.13.2 Kitchens shall comply with Chapter 64E-11, *Florida Administrative Code,* Food Preparation and Sanitation Requirements, as well as the 1985 NFPA 101, Chapters 12 and 13, Fire Safety Requirements as incorporated by reference in Chapter 59A3, *Florida Administrative Code* as adopted by the *Florida Fire Prevention Code.* Kitchens shall be designed with flow-through type operation where food arriving is immediately placed into dry storage or freezer units without walking through food preparation areas. The flow-through type system would provide for the preparation of food, serving and dishes returned with garbage and waste going out to an adjacent dumpster and can wash with water collection curbing and drain. A concrete pad shall be provided for the trash dumpster and garbage truck entrance.

427.1.4.13.3 Kitchens shall be equipped with fire suppression hoods and through-wall grease laden air evacuation and ventilation systems. All electrical outlets shall be ground-fault circuit interrupter protected. If meals are to be served via an open area, directly from the kitchen, this area shall have a fire-rated steel retractable overhead door type mechanism to continue the fire wall protection around the kitchen area. Kitchens shall have heat detectors rather than smoke sensors.

427.1.4.13.4 External to the kitchen, and outside the waste exit door, there shall be a curbed slop sink for mops and dirty kitchen water with an immediately accessible hose bibb and drain. This area shall be external to the kitchen area, but immediately adjacent to it, to provide ready disposal of waste water as well as for the removal of cleaning items from the kitchen when they are not in use.

427.1.4.13.5 There shall be a large food storage pantry in or adjacent to the kitchen.

427.1.4.13.6 Facilities using off-site kitchens for food preparation shall have an onsite food reception, warming, and holding area of sufficient size and with sufficient equipment to warm and hold food for each meal served. Required space shall include provision for proper disposal or holding of used implements and disposal of wet garbage in accordance with Chapter 64E-11, *Florida Administrative Code.*

427.1.4.14 Dining area. Each CSU or SRT shall have an attractive dining area on the unit. Seating capacity shall reflect the licensed capacity of the entire CSU or SRT, although residents may eat or be served in shifts during daily operations. Individual, rather than bench seating, shall be used for easy floor cleaning.

427.1.4.15 Unit laundry facilities.

427.1.4.15.1 Provision shall be made for the storage of soiled laundry in an adjacent, isolated, fire-resistant area.

427.1.4.15.2 Each CSU or SRT shall have a personal laundry room which shall incorporate a flow-through design in which dirty laundry enters, is sorted, placed in the washer, dried, folded, and moved out without crossing clean laundry with dirty laundry. CSUs and SRTs shall have a small washer and dryer for immediate unit needs and to wash clothes. These washing and drying units shall be equipped to sanitize clothes as a preventive measure of infection control.

427.1.4.15.3 The soiled laundry room shall have a locked door equipped with automatic door closer to restrict access to cleaning chemicals. The soiled laundry room air shall be exhausted outside the facility.

427.1.4.16 Clean laundry room.

427.1.4.16.1 A separate space shall be provided for clean laundry capable of storing an adequate supply of laundry for the size of the CSU or SRT. The laundry closet shall have a locked door to prevent access to these items by persons receiving services.

427.1.4.16.2 Items stored on the top shelf shall provide an 18 inch (457 mm) clear space from sprinkler heads so as to not block dispersal of water.

427.1.4.17 Fenced recreational area.

427.1.4.17.1 CSUs and SRTs shall have a no less than 6-foot-high (1829 mm) fenced, out-of-doors area where persons receiving services may have access to fresh air and exercise. It must provide privacy for persons receiving services otherwise exposed to public view. This area shall be constructed to retain persons inside the area and minimize elopements from the area, although it is not a secure area.

427.1.4.17.2 The fenced area shall provide some shaded area where persons receiving services may be out of doors without being in direct sunlight or may receive sunlight as they desire. The enclosing fences shall have an exit gate which is located away from the building as a secondary egress from the fenced area, for use in fire situations, or access by lawn maintenance equipment. The gate shall be provided with a lock which is readily accessible from both sides. The area of this fenced enclosure shall be at least 1,100 square feet (102 m^2) including an activity area having dimensions of not less than 20 feet by 40 feet (6096 mm by 1219 mm).

427.1.4.17.3 Objects shall not be placed near the fence to provide a ready step ladder over the fence and, if fabric fencing is used, the horizontal bracing used for corners shall be outside the fabric to preclude its use as an escape ladder step. The fenced area shall be designed, without blind corners, to be readily visible by one staff member standing in a central location. If desired, the fence may be topped with a 45-degree inward slanting restraining-type wire. The use of barbed wire and other sharp injurious materials, however, is prohibited.

427.1.4.17.4 This area, as all other primary fire exit routes, shall have egress lighting which is connected to the power side of the facility electrical panel so that in the event of a fire and electrical panel disconnect, the exit and congregation areas would still have lighting.

427.1.4.18 Multipurpose room. In addition to open, onunit floor space, each CSU and SRT shall have an accessible multipurpose room for group activities of at least 180 square feet (7 m^2). This area may be the dining area.

427.1.4.19 Off unit storage areas.

427.1.4.19.1 Each CSU and SRT shall have appropriate storage, in nonclient areas, for operating supplies and materials.

427.1.4.19.2 Adjacent nonclient area storage for personal belongings shall be a minimum of 8 cubic feet (.23 m^3) for each person receiving services.

427.2 Community mental health regulation. Adult residential treatment facilities (RTFs) shall be limited to adults and comply with the regulations in sections 427.2.1 through 427.2.4.

Note: Other administrative and programmatic provisions may apply. See Department of Children and Family Services (DCFS) Rule 65E-4.016, *Florida Administrative Code*, and Chapter 394, *Florida Statutes*.

427.2.1 Facility standards.

427.2.1.1 Building construction requirements. The construction and renovation of a facility shall comply with the provisions of the *Florida Building Code*.

427.2.2 Health and safety. Facilities and additions shall be constructed to allow full compliance with the provisions of this section.

427.2.2.1 Fire safety.

427.2.2.1.1 Residential treatment facilities shall comply with all applicable federal, state and local fire safety standards as follows:

1. Level IA licensed facilities shall comply with the fire codes contained in Chapter 69A-3, *Fire Prevention-General Provisions*, *Florida Administrative Code,* as described in the NFPA. 101, Chapters 18 and 19, Special Definitions as adopted by the *Florida Fire Prevention Code*, as applicable to limited health care facilities.
2. For facility Level IB, which may have no more than three residents incapable of selfpreservation, and for facility Levels II, III, IV and V, which may have no residents incapable of self-preservation, each resident record shall have a signed statement by a physician or licensed psychologist regarding the resident's capability of self-preservation.
3. Facility Levels IB, II, III, IV and V shall have a prompt evacuation capability.

427.2.2.1.2 Level IV and V facilities shall have a written policy on the safe use of extension cords and adapters. The use of extension cords and adaptors is prohibited in Level I, II and III facilities.

427.2.2.1.3 Electrical cords and appliances shall be maintained in a safe condition.

427.2.2.1.4 Portable heating devices shall be used only in emergency situations as defined in agency procedures approved by the governing board.

427.2.2.1.5 Flammable liquids or gas cylinders shall not be positioned near flame or heat sources, nor stored with combustible materials.

427.2.2.1.6 Emergency power. The facility shall provide egress lighting that will operate in the event of a power failure.

427.2.2.1.7 Smoking. The program shall have a written policy governing smoking in the facilities. Smoking shall be prohibited in any area of the facility where combustible supplies, materials, liquids or gases will be used or stored.

427.2.2.1.8 Fire safety inspections. A fire safety inspection shall be obtained before occupying any new physical facility or addition.

427.2.2.2 Personal safety.

427.2.2.2.1 The building shall be free of hazards such as cracks in the floors, walls or ceiling; warped or loose boards, tile, linoleum, handrails or railings; and broken window panes or missing window screens.

427.2.2.2.2 Protection shall be provided from sharp or jagged projections, "invisible" glass, moving parts, heated surfaces, heavy objects that could fall, or any other potentially hazardous condition.

427.2.2.2.3 Grab bars shall be nonremovable.

427.2.2.2.4 The temperature of the hot water supply shall be regulated and shall be between 105°F (41°C) and 115°F (46°C) at the outlet.

427.2.2.2.5 Any electrical fans, except ceiling paddle fans, shall be screened. All electrical fans, including paddle fans, shall be placed in a safe location.

427.2.2.2.6 Indoor and outdoor recreational areas shall be provided with safeguards designed for the needs of the residents.

427.2.2.2.7 Outdoor recreational areas shall be well drained.

427.2.2.3 Health and sanitation.

427.2.2.3.1 Appropriate health and sanitation inspection certificates shall be obtained before occupying any new physical facility or addition, and at least yearly or as required by statute, thereafter. A report of the most recent inspection must be on file and accessible to authorized individuals.

427.2.2.3.2 Hot and cold running water under pressure shall be readily available in all washing, bathing and food preparation areas.

427.2.2.3.3 The kitchen and food preparation area shall be well-lighted, ventilated and located apart from areas which could cause food contamination. All doors and windows in the kitchen and food preparation areas that open to the outside shall be screened.

427.2.3 Food service.

427.2.3.1 For food service areas with a capacity of 13 or more residents, all matters pertaining to food service

shall comply with the provisions of Chapter 64E-11, *Florida Administrative Code.*

427.2.3.2 Food preparation, sanitation and storage.

427.2.3.2.1 Each refrigerator or freezer used for storage of perishable foods shall be provided with an accurate indicating thermometer located in the warmest part toward the front side of the refrigerator or freezer so that the temperature can be easily and readily observed.

427.2.3.2.2 Freezers should be kept at or below 0°F (-18°C).

427.2.3.3 Dining.

427.2.3.3.1 Dining tables shall seat small groups of residents unless other arrangements are justified on the basis of resident needs.

427.2.3.3.2 The dining area shall be suitably lighted, ventilated and furnished.

427.2.4 Environment.

427.2.4.1 Residential facilities shall not be identified by an exterior sign or vehicle sign that labels the residents or special functions of the facility. Vehicle traffic and parking relating to the facility shall be similar to that of surrounding structures or residences.

427.2.4.2 The grounds of the facility shall have adequate space for resident activities.

427.2.4.3 The facility shall be accessible to persons with disabilities or the facility shall have written policies and procedures that describe how disabled individuals can gain access to the facility for necessary services.

427.2.4.4 Areas that accommodate the following shall be available:

1. A full range of social activities;
2. Private conversations;
3. Group activities; and
4. Resident privacy, when appropriate.

427.2.4.5 All areas of the facility occupied by residents shall be climatically controlled in a manner conducive to the comfort and privacy of the residents and shall include the following:

427.2.4.5.1 A design temperature of at least 72°F (22°C) and not to exceed 85°F (29°C)shall be used for waking hours in all areas used by residents. During sleeping hours, a temperature of at least 68°F (20°C) shall be used. These temperature requirements apply unless otherwise mandated by federal or state authorities.

427.2.4.5.2 When cooling devices are used, they shall be placed or adjusted in a manner which minimizes drafts.

427.2.4.6 Drinking water shall be readily available and easily accessible to residents.

427.2.4.7 Mirrors reasonably free of distortion shall be placed in appropriate places to aid in grooming and to enhance self-awareness.

427.2.4.8 Clocks shall be provided to promote awareness of time and day.

427.2.4.9 The use of door locks or closed sections of the building shall comply with all applicable safety standards.

427.2.4.10 Clean, well-lighted and ventilated laundering facilities for resident use shall be available on the premises or in the immediate neighborhood.

427.2.4.11 A telephone which allows private conversations shall be available and easily accessible within the facility.

427.2.4.12 Facility lighting shall promote clear perceptions of people and functions. When and where appropriate, lighting shall be controlled by residents.

427.2.4.13 Whenever feasible, the environment shall provide views of the outdoors.

427.2.4.14 Bedrooms. Bedrooms shall be designed to meet the following criteria:

427.2.4.14.1 All resident bedrooms shall be ventilated, well-lighted and located convenient to a bathroom.

427.2.4.14.2 Resident bedrooms designated for single occupancy shall provide a minimum inside measurement of 80 square feet (7 m^2) of usable floor space.

427.2.4.14.3 Resident bedrooms designated for multiple occupancy shall provide a minimum inside measurement of 60 square feet (6 m^2) of usable floor space per bed and be limited to four occupants.

427.2.4.14.4 All resident bedrooms shall open directly into a corridor, a common use area or the outside, except in those facilities comprised of apartments.

427.2.4.14.5 Each resident bedroom where furnishings are supplied by the facility shall be furnished with personal storage space and adequate space for hanging clothes

427.2.4.14.6 Bedroom doors shall not have vision panels.

427.2.4.15 Bathrooms. Bathrooms shall be designed to meet the following criteria:

427.2.4.15.1 A toilet and lavatory facility shall be provided for every six residents, and toilets shall be equipped with seats.

427.2.4.15.2 A minimum of one tub or shower facility, equipped with nonslip devices, shall be provided for every eight residents.

427.2.4.15.3 Bathrooms shall be ventilated, adequately lighted and have clearly labeled hot and cold running water.

427.2.4.15.4 Each bathroom shall have a door in working order to assure privacy.

427.2.4.15.5 When there is more than one toilet or bathing facility in a bathroom, provisions are required for privacy.

427.2.4.15.6 Bathrooms used by residents with disabilities shall be equipped to ensure safety and independent mobility.

427.2.4.15.7 Sole access to toilet or bathing facilities shall not be through another resident's sleeping room, except in facilities comprised of apartments.

427.2.4.16 Common living areas. Common living areas shall be designed to meet the following criteria:

427.2.4.16.1 A room, separate from sleeping areas, shall be provided where residents may read or engage in socialization or other leisure time activities.

427.2.4.16.2 A minimum of 35 square feet (3 m^2) of living and dining space per resident shall be provided by all facilities except those comprised of apartments. This space shall include living, recreational and other space designated accessible to residents, but shall not include bathrooms, corridors, storage space, or screened porches which cannot be adapted for year round use. Facilities with bedrooms which include living space may count the square footage that is in excess of the bedroom square footage requirements as part of the 35 square footage (3 m^2) living and dining space requirements.

SECTION 428
MANUFACTURED BUILDINGS

428.1 General. The following administrative requirements for inspection and plan review apply to manufactured buildings including factory-built schools. Additional technical requirements for factory-built schools can be found in Section 423.

Note: See Department of Community Affairs (DCA) Rule 9B-1, *Florida Administrative Code* and Chapter 553, *Florida Statutes*.

428.2 Definitions.

428.2.1 "Third-party agency" means an individual or entity authorized to perform inspections of or review plans for manufactured buildings as provided by Rule 9B-1, *Florida Administrative Code*.

428.2.2 "Factory-built school" means any building designed or intended for use as a school building which is manufactured in whole or in part at an off-site facility, including prefabricated educational facilities, factory-built educational facilities and modular built educational facilities that are designed to be portable, relocatable, demountable or reconstructible, are used primarily as classrooms or the components of an entire school and do not fall under the provisions of Sections 320.822-320.862, *Florida Statutes*.

428.2.3 Department. Refers to Department of Community Affairs.

428.3 Inspections. Inspection of installation of manufactured buildings and construction activities conducted at the site of the installation shall by conducted pursuant to Chapter 1 hereof. Inspections during the manufacturing process shall be conducted by those third-party agencies as follows:

428.3.1 Inspections shall be conducted at the manufacturing facility by an appropriately licensed representative of a third-party agency selected by the manufacturer. The inspections shall be to ensure that the buildings are being manufactured in compliance with the applicable codes and the approved plans. Once a third-party agency has inspected a manufactured building, the manufacturer shall not seek to have the building inspected by another agency, nor shall any agency inspect a building that has already been inspected by another unless the subsequent inspection is at the direction of the department or unless the building or modification thereto is being inspected for recertification by the department.

428.3.2 At a minimum, a certified third-party agency shall meet the criteria in Sections 428.3.2.1 through 428.3.2.4.

428.3.2.1 With regard to manufactured buildings, observe the manufacture of the first building built subsequent to the plan approval or the selection of the agency, whichever occurs last, from start to finish, inspecting all subsystems thereof. Continual observation and inspection shall continue until the third-party agency determines that the implementation of the manufacturer's quality control program in conjunction with application of the approved plans and specifications and the manufacturer's capabilities result in a building that meets or exceeds the standards adopted herein. Thereafter, the agency shall inspect each module produced during at least one point of the manufacturing process and shall inspect the entire production line during each plant inspection, so that a minimum of 75 percent of the modules inspected will have a minimum of one of the subsystems (electrical, plumbing, structural, mechanical or thermal) exposed for inspection.

428.3.2.2 With regard to components, observe the manufacture of the first unit assembled subsequent to the plan approval or the selection of the agency, whichever occurs last, from start to finish, inspecting all subsystems thereof. Continual observation and inspection shall continue until the third-party agency determines that the implementation of the manufacturer's quality control program in conjunction with application of the approved plans and specifications and the manufacturer's capabilities result in a component that meets or exceeds the codes and standards adopted herein. Thereafter, the third-party agency shall inspect not less than 50 percent of the manufactured building components or 20 percent of storage sheds that are not designed for human habitation and that have a floor area of 720 square feet (67 m^2) or less manufactured pursuant to the approved plan,

428.3.2.3 During each inspection, the agency shall verify that the manufacturer's inplant quality control program is working as set forth in the approved quality control manual.

428.3.2.4 Should work stop on a particular module or component for a period of two months, reinspection shall be required.

428.3.3 When a third-party agency discovers a deviation from the code or the approved plans which creates or threatens an imminent life safety hazard, all buildings or components which have progressed through that stage of production since the agency's previous inspection shall be inspected to ensure the absence of that deviation, and the agency shall immediately notify the manufacturer and the department in writing. Any building or component exhibiting the deviation shall be brought into conformance with the applicable code or the approved plans by the manufacturer within thirty days of notification of the deviation by the third party agency. The corrective action must be left available for reinspection by the third-party agency.

428.3.4 The third-party agency shall note all inspections, deviations and corrective actions in a written inspection report and shall complete the inspection report portion of the building code information system available via the Internet.

428.3.5 The agency shall give a copy of the inspection report(s) to the manufacturer for record and shall retain another copy. The agency or the manufacturer shall provide a copy of an inspection report to the department when requested.

428.4 Design plan and systems approval. Plan review pertaining to installation of manufactured buildings and construction activities conducted at the site of the installation shall be conducted pursuant to Chapter 1 hereof. Plan review pertaining to construction activities occurring within the manufacturing process shall be conducted by those third-party agencies as follows: third-party agencies shall review plans in conformity with Chapter 1 hereof and the following additional requirements: If the plans are for a residential manufactured building, certification from the design professional responsible for the plans that the structure has been designed only for erection or installation on a site built foundation in accordance with this code. If the residential manufactured building is transportable in one or more sections and is 8 body feet or more in width or 40 body feet (12 192 mm) or more in length, or, when erected on site, is 320 square feet (29 m^2) or more, and which is built on a permanent chassis, the manufacturer shall certify that the manufactured building has been excluded from regulation by the United States Department of Housing and Urban Development.

428.4.1 Plan approval expiration. Upon revision of the *Florida Building Code* plan approvals shall expire upon the latter of the effective date of that revision or 90 days from adoption of that revision by the Florida Building Commission unless the manufacturer files with the department a sworn statement by a third-party agency that the plans have been reviewed and that they are in compliance with the revisions to the *Florida Building Code*.

428.4.2 Evidence of third-party agency approval. Approved plans and specifications shall be evidenced by a letter certificate from the agency. Approved copies of the design plans and specifications shall be returned to the manufacturer with an agency approval letter indicating the limitations, if any, of such approval. An approved copy of the plans shall be available at each place of manufacture, which shall be made available for inspection and monitoring. Upon approval of the plans, the third-party agency shall submit a copy of the plans bearing the approval stamp to the department together with a list of any limitations of that plan approval and a separate copy of the plans and limitations on compact disk in a readable format.

428.5 Alterations.

428.5.1 On-site modifications. On-site modification to manufactured buildings must be inspected by either a third party agency or by the authority having jurisdiction and must comply with the *Florida Building Code*. The authority having jurisdiction has superseding authority over any onsite modifications to a manufactured building or may delegate this authority to the department in writing on a case-by-case basis. Upon issuance of a certificate of occupancy for the modified manufactured building, the old insignia shall be removed and returned to the department.

428.5.2 In order to recertify a used manufactured building that is being relocated and not otherwise altered, the owner must provide the approved inspection agency with a set of the original approved plans for the building and any modification of the building. As-built plans shall be acceptable as an alternative to approved plans for factory-built schools manufactured prior to July 1, 2001. Once the agency has evaluated the continued compliance of the building with those plans and certifies to the department that the building is in compliance with the applicable codes, the approved inspection agency shall affix a recertification insignia to the building. If a building complied with the code in effect on the date of the original plan approval, the applicable code as set forth above shall be that which was in effect on the date of the original plan approval. The relocation of a manufactured building does not constitute an alteration.

428.6 Factory-built schools, plan review (also see Section 423, State requirements for education facilities). Plan review of plans for newly constructed factory-built schools shall be performed by the third-party agency selected by the department. An applicant for plan approval shall submit complete plans to an agency in the manner and format agreed to by the agency and the applicant. Plan submittals shall include a schedule of inspections which shall be performed periodically as necessary to ensure that the building complies with applicable standards. Upon determination by the agency that the plans submitted comply with all applicable standards, the agency shall certify such determination by affixing an approval stamp on each page of the plans, and shall return one copy to the applicant, maintain an original set, and submit one copy electronically to the department. The agency shall be compensated for the actual cost of the plan review by the applicant. No manufacturing activity shall commence until plan approval has been obtained from the third-party agency. Plan review at a minimum shall include those items identified in Chapter 1 hereof. Plans for modification of factory-built schools shall be reviewed by an approved third-party agency selected by the manufacturer as set forth in 9B-1.009, *Florida Administrative Code*.

428.7 Factory-built schools, inspections and work progress reports (also see Section 423, state requirements for education facilities).

428.7.1 Inspectors. The school board or community college (educational entity) which is to utilize the factory-built school shall be responsible for compliance with inspection requirements.

428.7.2 Existing buildings. Factory-built schools designated as existing buildings shall be inspected to determine compliance with the standards adopted in Section 423 hereof. All deficiencies shall be noted in an inspection report provided to the educational entity upon completion of the inspection. Activities performed to rehabilitate a noncompliant building shall be subject to plan review and reinspection. Upon an inspector's determination that the building complies with the applicable standards, the inspector shall provide to the department the information as required on the data plate for the building and identify the building as satisfactory for use as an educational facility on the building code information system.

428.7.3 New construction. All buildings other than existing buildings shall be subject to inspection during the manufacturing process. The educational entity shall ensure that factory inspections are performed periodically and are sufficient to ensure that the building and its systems comply with the applicable standards. The inspector shall require the correction of all deficiencies found during the manufacturing process. Upon an inspector's determination that the building complies with the applicable standards, the inspector shall provide to the department the information as required on the data plate for the building and identify the building as satisfactory for use as an educational facility on the building code information system.

SECTION 429
BOOT CAMPS FOR CHILDREN

429.1 Boot camps for children shall comply with the design and construction standards as described herein. Enforcement and interpretation of theses provisions shall be by the entities authorized by Chapter 553.80, *Florida Statutes*.

Note: Other administrative and programmatic provisions may apply. See Department of Juvenile Justice Rule 63-E 2, *Florida Administrative Code*, and Chapter 39, *Florida Statutes*.

429.2 Facility structural and operational standards.

429.2.1 The facility shall conform to the *Florida Fire Prevention Code.* All new construction and building renovations shall comply with the *Florida Building Code.*

429.2.2 All juvenile justice residential treatment program facilities shall conform to the *Florida Building Code.*

429.2.3 All juvenile justice residential treatment program facilities shall comply with the sanitation, health and fire codes set forth in the *Florida Building Code* and in the *Florida Fire Prevention Code.*

SECTION 430
MAUSOLEUMS AND COLUMBARIUMS

430.1 General. The provisions of Section 430 shall apply to buildings or structures as defined in Section 202 as chapel mausoleums, garden mausoleums, nonvisitation crypt mausoleums, and columbariums. All crypts and niches built after this code becomes effective shall conform to this code.

430.2 Occupancy classification. Mausoleums and columbariums shall be classified as a Group S2 low hazard storage occupancy.

430.3 Construction type. Mausoleums, columbariums and accessory occupancies shall be of Type I unsprinklered, Type II unsprinklered, or Type IIB unsprinklered construction.

430.4 Accessory occupancies. Accessory occupancies shall comply with Sections 302.1 and 302.2.

430.5 Structural loads. Mausoleums and columbariums shall be designed to comply with the structural design requirements of Chapter 16. Crypts shall be designed for a minimum total live load of 35 psf ($2kN/m^2$).

430.6 Mausoleum and columbarium construction. The design and construction of mausoleums and columbariums shall comply with the *Florida Building Code, Building* and Section 430.6.

430.6.1 Plumbing systems. Mausoleums and columbariums shall not be required to comply with the *Florida Building Code, Plumbing.*

Exception: Accessory areas and an occupancy in a mixed occupancy building shall comply with *Florida Building Code, Plumbing.* The number and location of plumbing facilities shall be based on the accessory areas and the mixed occupancy areas.

430.6.2 Mechanical systems. Mausoleums and columbariums shall not be required to comply with the *Florida Building Code, Mechanical.*

Exceptions:

1. Accessory areas and an occupancy in a mixed occupancy building shall comply with *Florida Building Code, Mechanical.* Mechanical systems shall be based on the accessory areas and the mixed occupancy areas.
2. Crypt pressure relief system shall comply with Section 430.7.2 except that for family mausoleum units where all crypts are bordering an exterior wall, pressure relief ventilation shall be provided from the crypt to the outside of the mausoleum through the exterior wall or roof.
3. Niches shall not require pressure relief systems.

430.6.3 Fire protection systems. Mausoleums and columbariums shall not be required to comply with Chapter 9, Fire Protection Systems.

Exception: Accessory areas and an occupancy in a mixed occupancy building shall comply with Chapter 9. The fire protection systems shall be based on the accessory areas and the mixed occupancy areas.

430.6.4 Interior finish. The interior finish for mausoleums and columbariums shall be Class A for exits and exit access and Class B for other spaces. The floor tile, marble, and granite used in a chapel mausoleum shall comply with the Marble Institute of America (1998).

430.6.5 Exterior finish. The exterior finish for mausoleums and columbariums shall be one or more of the following finishes:

Granite
Marble
Rubbed concrete
Painted concrete
Stucco
Synthetic stucco
Waterproofing products
Tile

430.7 Crypts.

430.7.1 Crypts construction. Crypts and companion crypts shall be constructed of reinforced concrete complying with Chapter 19 and 430.7.1.

430.7.1.1 Cast in place crypt. Cast in placed crypts shall have a minimum thickness of 3 inches (76 mm) for floor slabs, walls, and other structural framework.

430.7.1.2 Precast crypt. Concrete shall have a minimum specified compressive strength f'_c of 5,000 psi (34.5 mPa). Crypt floor slabs and roof slabs shall have a minimum thickness of 2½ inches (63.5 mm) Crypt walls shall be a minimum thickness of 3½ inches (88.9 mm) at the top of the wall to a minimum of 2 inches (50.8 mm) at the bottom of the wall.

430.7.1.3 Crypt front. Crypt fronts are to be independent of the crypt panel. The front shall be Grade A exterior type granite or marble according to the Marble Institute of America (1998), or travertine, or bronze, or tile mosaic. The front shall be installed with a hanger system. The hangers, clips, and other exterior or interior fastenings shall be of copper-based alloy, copper, or stainless steel designed for strength and durability. Aluminum fastenings may be used if they will not react with any material or metal that they may come in contact with and when not embedded in concrete. The front, trim, and wall stone shall be a minimum ¾ inch (19.1 mm) thick, other materials used for crypt fronts shall be the thickness as dictated at the time by modern mausoleum construction.

430.7.2 Crypt relief vent. For family mausoleum units where all crypts are bordering an exterior wall, pressure relief ventilation shall be provided from the crypt to the outside of the mausoleum through the exterior wall or roof. For all other mausoleum units, each crypt shall have a pressure relief vent from the crypt to the roof of the mausoleum complying with Section M515, Mausoleum relief system, of the *Florida Building Code, Mechanical.* Niches shall not require pressure relief systems.

430.8 Casket placement. Casket placement shall have minimum interior dimensions of 2 feet 6 inches (762 mm) wide mm) by 2 feet 1 inch (635 mm) high by 7 feet 3½ inches (2223 mm) deep.

430.9 Niches. Niches shall be designed and constructed in accordance with Section 430.9.

430.9.1 Minimum size. Niches shall have a minimum volume of 200 cubic inches (7 m^3) with a minimum width of 4½ inches (114.3 mm), a minimum height of 9 inches (228.6 mm), and a minimum depth of 5 inches (127 mm).

430.9.2 Niche front. The niche front shall be Grade A exterior-type granite or marble according to the marble Institute of America (1998), or travertine, bronze, tile mosaic, glass, lexan, or plexiglass.

430.9.3 Pressure relief systems. Niches shall not require pressure relief systems.

430.9.4 Wall thickness. Niche wall thickness shall be the thickness as dictated at the time of construction by modern mausoleum and columbarium construction.

430.10 Family mausoleum. Family mausoleums consisting of six or fewer casket placements shall comply with either Sections 430.1 or 430.10.

430.10.1 Materials. Family mausoleums shall be constructed of the materials in Sections 430.10.1.1 through 430.10.1.6.

430.10.1.1 Reinforced concrete floor. Reinforced concrete floor shall have a minimum specified compressive strength f'_c of 5,000 psi (34.5 mPa).

430.10.1.2 Hardware. Hardware and fasteners shall be of stainless steel or bronze.

430.10.1.3 Doors. When installed, doors and door hardware shall be bronze.

430.10.1.4 Crypt front. Crypt fronts shall be granite or marble.

430.10.1.5 Walls and roof. Walls and roof shall be of granite, marble or reinforced concrete.

430.10.1.6 Floor. The floor shall be granite, marble, or reinforced concrete.

430.10.2 Crypt relief vent. For family mausoleum units where all crypts are bordering an exterior wall, pressure relief ventilation shall be provided from the crypt to the outside of the mausoleum through the exterior wall or roof.

For family mausoleum units where all crypts are not bordering an exterior wall, each crypt shall have a pressure relief vent from the crypt to the roof of the mausoleum complying with Section M515, Mausoleum relief system, of the *Florida Building Code, Mechanical.*

430.10.3 minimum thickness. The minimum thickness for the components of a family mausoleum shall comply with Section 430.10.3.

430.10.3.1 Family mausoleum. Exterior walls shall be a minimum of 4 inches (101.6 mm). Roof shall be minimum of 6 inches (152 mm). Floor shall be a minimum of 6 inches (152 mm) granite, marble, or reinforced concrete. Shelves shall be a minimum of 2 inches (51 mm). Crypt fronts shall be a minimum of ¾ inch (19.1 mm).

430.10.3.2 Burial chamber mausoleum. Exterior walls shall be a minimum of 6 inches (152 mm). Roof shall be a minimum of 6 inches (152 mm). Floor shall be a mini-

mum of 8 inches (203 mm) granite. Shelves shall be a minimum of 2 inches (51 mm). Crypt fronts shall be a minimum of ¾ inch (19.1 mm).

SECTION 431
TRANSIENT PUBLIC LODGING ESTABLISHMENTS

431.1 Any transient public lodging establishment, as defined in Chapter 509, *Florida Statutes*, and used primarily for transient occupancy as defined in Section 83.43(10), *Florida Statutes*, or any timeshare unit of a timeshare plan as defined in Chapters 718 and 721, *Florida Statutes*, which is of three stories or more and for which the construction contract has been let after the effective date of this code, with interior corridors which do not have direct access from the guest area to exterior means of egress and on buildings over 75 feet (22 860 mm) in height that have direct access from the guest area to exterior means of egress and for which the construction contract has been let after the effective date of this code, shall be equipped with an automatic sprinkler system installed in compliance with the provisions prescribed in the NFPA 13, *Standards for the Installation of Sprinkler Systems.* Each guestroom and each timeshare unit shall be equipped with an approved listed single-station smoke detector meeting the minimum requirements of NFPA 74, *Standards for the installation, maintenance and Use of Household Fire Warning Equipment,* powered from the building electrical service, notwithstanding the number of stories in the structure, if the contract for construction is let after the effective date of this code. Single-station smoke detectors shall not be required when guest- rooms or timeshare units contain smoke detectors connected to a central alarm system which also alarms locally.

SECTION 432
USE OF ASBESTOS IN NEW PUBLIC BUILDINGS OR BUILDINGS NEWLY CONSTRUCTED FOR LEASE TO GOVERNMENT ENTITIES-PROHIBITION

432.1 The use of asbestos or asbestos-based fiber materials is prohibited in any building, construction of which is commenced after September 30, 1983, which is financed with public funds or is constructed for the express purpose of being leased to any governmental entity.

SECTION 433
ADULT DAY CARE

433.1 General. Adult day care facilities shall comply with the following design and construction standards.

Note: See Agency for Health Care Administration (AHCA) Rule 58A-6, *Florida Administrative Code*, and Chapter 400, Part V, *Florida Statutes*.

433.2 Definitions.

"Adult day care center" or **"center"** means any building, buildings, or part of a building, whether operated for profit or not, in which is provided through its ownership or management, for a part of a day, basic services to three or more persons who are 18 years of age or older, who are not related to the owner or operator by blood or marriage, and who require such services. The following are exempt from this part:

1. Any facility, institution, or other place that is operated by the federal government or any agency thereof.
2. Any freestanding inpatient hospice facility that is licensed by the state and which provides day care services to hospice patients only.
3. A licensed assisted living facility, a licensed hospital, or a licensed nursing home facility that provides services during the day which include, but are not limited to, social, health, therapeutic, recreational, nutritional and respite services, to adults who are not residents, so long as the facility does not hold itself out as an adult day care center.

"Capacity" shall mean the number of participants for which a center has been licensed to provide care at any given time and shall be based upon required net floor space.

"Net floor space" shall mean the actual climatically con trolled occupied area, not including accessory unoccupied areas such as hallways, stairs, closets, storage areas, bathrooms, kitchen or thickness of walls, set aside for the use of the day care center participants.

"Participant space" shall mean the required net floor space per participant. Maximum participant capacity shall refer to the licensed capacity.

433.3 The following minimum conditions shall be met:

433.3.1 The floor surface in kitchens, all rooms and areas in which food is stored or prepared and in which utensils are washed or stored shall be of smooth nonabsorbent material and constructed so it can be easily cleaned and shall be washable up to the highest level reached by splash or spray.

433.3.2 The walls and ceilings of all food preparation, utensil washing and hand washing rooms or areas shall have smooth, easily cleanable surfaces. Walls shall be washable up to the highest level reached by splash or spray.

433.3.3 Hot and cold running water under pressure shall be easily accessible to all rooms where food is prepared or utensils are washed.

433.3.4 Hand-washing facilities, provided with hot and cold running water, shall be located within the food preparation area in new adult day care facilities and adult day care facilities which are extensively altered.

433.3.5 Multiuse equipment and utensils shall be constructed and repaired with materials that are nontoxic, corrosion resistant and nonabsorbent; and shall be smooth, easily cleanable and durable under conditions of normal use; and shall not impart odors, color or taste nor contribute to the contamination of food.

433.3.6 A three-compartment sink or a two-compartment sink and a dishwater with an effective, automatic sanitizing cycle, shall be provided.

433.3.7 Refrigeration units and hot food storage units used for the storage of potentially hazardous foods shall be provided with a numerically scaled indicating thermometer accurate to plus or minus 3°F (-16°C). The thermometer

shall be located in the warmest or coldest part of the units and of such type and so situated that the temperature can be easily and readily observed.

433.4 Participant and program data, emergency procedures. Fire safety protection shall be governed in accordance with the *Florida Fire Prevention Code.*

433.5 Physical plant, sanitary conditions, housekeeping standards and maintenance.

433.5.1 The participant capacity shall be determined by the total amount of net floor space available for all of the participants. Centers shall provide not less than 45 square feet (4 m^2) of net floor area per participant. Centers shall be required to provide additional floor space for special target populations to accommodate activities required by participant care plans.

433.5.2 Facilities exempt pursuant to Section 400.553, *Florida Statutes*, shall utilize separate space over and above the minimum requirement needed to meet their own licensure certification approval requirements. Only congregate space shall be included in determining minimum space. For purposes of this section, congregate space shall mean climatically controlled living room, dining room, specialized activity rooms, or other rooms to be commonly used by all participants.

433.5.3 Center facilities shall consist of, but not be limited to, the following:

1. Bathrooms.
2. Dining areas.
3. Kitchen areas.
4. Rest areas.
5. Recreation and leisure time areas.

433.5.4 A private area shall be available for the provision of first aid, special care and counseling services when provided, or as necessary for other services required by participants. This area shall be appropriately furnished and equipped.

433.5.5 Bathrooms shall be ventilated and have hot and cold running water, supplying hot water at a minimum of 105°F (41°C) and a maximum of 115°F (46°C).

433.5.6 Recreation and leisure time areas shall be provided where a participant may read, engage in socialization or other leisure time activities. The recreation areas also may be utilized for dining areas.

433.5.7 All areas used by participants shall be suitably lighted and ventilated and maintained at a minimal inside temperature of 72°F (22°C) when outside temperatures are 65°F (18°C) or below, and all areas used by participants must not exceed 90°F (32°C). Mechanical cooling devices must be provided when indoor temperatures exceed 84°F (29°C). The facility shall have a thermometer which accurately identifies the temperature.

SECTION 434
ASSISTED LIVING FACILITIES

434.1 Scope. Assisted living facilities shall comply with the following design and construction standards as described herein.

Note: Other administrative and programmatic provisions may apply. See Agency of Health Care Administration (AHCA) Rule 58A-5, *Florida Administrative Code* and Chapter 400 Part III, *Florida Statutes*.

434.2 Definitions.

AGENCY. The Agency for Health Care Administration.

ASSISTED LIVING FACILITY. Any building or buildings, section or distinct part of a building, private home, boarding home, home for the aged or other residential facility, whether operated for profit or not, which undertakes through its ownership or management to provide housing, meals and one or more personal services for a period exceeding 24 hours to one or more adults who are not relatives of the owner or administrator. The following are exempted from this definition:

1. Any facility, institution, or other place operated by the federal government or any agency of the federal government.
2. Any facility or part of a facility licensed under Chapter 393, *Florida Statutes*, or Chapter 394, *Florida Statutes*.
3. Any facility licensed as an adult family care home under Part VII Chapter 400, *Florida Statutes*.
4. Any person who provides housing, meals and one or more personal services on a 24-hour basis in the person's own home to not more than two adults who do not receive optional state supplementation. The person who provides the housing, meals, and personal services must own or rent the home and reside therein.
5. Any home or facility approved by the United States Department of Veterans Affairs as a residential care home wherein care is provided exclusively to three or fewer veterans.
6. Any facility that has been incorporated in this state for 50 years or more on or before July 1, 1983, and the board of directors of which is nominated or elected by the residents, until the facility is sold or its ownership is transferred; or any facility, with improvements or additions thereto, which has existed and operated continuously in this state for 60 years or more on or before July 1, 1989, is directly or indirectly owned and operated by a nationally recognized fraternal organization, is not open to the public, and accepts only its own members and their spouses as residents.
7. Any facility certified under Chapter 651, *Florida Statutes*, or a retirement community, may provide services authorized under this section or Part IV of Chapter 400, *Florida Statutes* to its residents who live in single-family homes, duplexes, quadruplexes, or apartments located on the campus without obtaining a license to operate an assisted living facility if residential units

within such buildings are used by residents who do not require staff supervision for that portion of the day when personal services are not being delivered and the owner obtains a home health license to provide such services. However, any building or distinct part of a building on the campus that is designated for persons who receive personal services and require supervision beyond that which is available while such services are being rendered must be licensed in accordance with this section. If a facility provides personal services to residents who do not otherwise home health agency, the buildings or distinct parts of buildings where such services are rendered must be licensed under this section. A resident of a facility that obtains a home health license may contract with a home health agency of his or her choice, provided that the home health agency provides liability insurance and workers' compensation coverage for its employees. Facilities covered by this exemption may establish policies that give residents the option of contracting for services and care beyond that which is provided by the facility to enable them to age in place. For purposes of this section, a retirement community consists of a facility licensed under this section or under Part II of Chapter 400, *Florida Statutes*, and apartments designed for independent living located on the same campus.

8. Any residential unit for independent living which is located within a facility certified under Chapter 651 *Florida Statutes*, or any residential unit which is colocated with a nursing home licensed under Part II of Chapter 400 *Florida Statutes*. or colocated with a facility licensed under this section in which services are provided through an outpatient clinic or a nursing home on an outpatient basis.

DEPARTMENT. The Department of Elderly Affairs.

EXTENDED CONGREGATE CARE. Acts beyond those authorized in subsection (5) that may be performed pursuant to part I of Chapter 464, *Florida Statutes*, by persons licensed thereunder while carrying out their professional duties. The purpose of such services is to enable residents to age in place in a residential environment despite mental or physical limitations that might otherwise disqualify them from residency in a facility licensed under this part.

PERSONAL SERVICES. Direct physical assistance with or supervision of the activities of daily living and the self-administration of medication and other similar services which the department may define by rule. Personal services shall not be construed to mean the provision of medical, nursing, dental or mental health services.

RELATIVE. An individual who is the father, mother, stepfather, stepmother, son, daughter, brother, sister, grandmother, grandfather, great-grandmother, great-grandfather, grandson, granddaughter, uncle, aunt, first cousin, nephew, niece, husband, wife, father-in-law, mother-in-law, son-in-law, daughter-in-law, brother-in-law, sister-in-law, stepson, stepdaughter, stepbrother, stepsister, half brother or half sister of an owner or administrator.

RESIDENT. A person 18 years of age or older, residing in and receiving care from a facility.

RESIDENT'S REPRESENTATIVE OR DESIGNEE. A person other than the owner, or an agent or employee of the facility, designated in writing by the resident, if legally competent, to receive notice of changes in the contract executed pursuant to Section 400.424, *F.S.*; to receive notice of and to participate in meetings between the resident and the facility owner, administrator or staff concerning the rights of the resident; to assist the resident in contacting the ombudsman council if the resident has a complaint against the facility; or to bring legal action on behalf of the resident pursuant to Section 400.429, *Florida Statutes*.

AHCA CENTRAL OFFICE. The Assisted Living Unit, Agency for Health Care Administration.

CAPACITY. The number of residents for which a facility has been licensed to provide residential care.

DISTINCT PART. Designated bedrooms or apartments, bathrooms and a living area; or a separately identified wing, floor or building which includes bedrooms or apartments, bathrooms and a living area. The distinct part may include a separate dining area, or meals may be served in another part of the facility.

DOEA ASSISTED LIVING PROGRAM. The Assisted Living Program, Department of Elder Affairs.

FOOD SERVICE. The storage, preparation, serving and cleaning up of food intended for consumption in a facility or a formal agreement that meals will be regularly catered by a third party.

RENOVATION. Additions, repairs, restorations or other improvements to the physical plant of the facility within a five-year period that costs in excess of 50 percent of the value of the building as reported on the tax rolls, excluding land, before the renovation.

434.3 Codes and standards for the design and construction of assisted living facilities. Except as modified and required by this section of the code, Chapter 58A-5, *Florida Administrative Code* or Chapter 429 Part III, *Florida Statutes*, all new assisted living facilities and all additions, alterations, or renovations to existing assisted living facilities with more than 16 licensed beds shall also be in compliance with *The Guidelines for the Design and Construction of Health Care Facilities* (The Guidelines) Part I General, and Chapter 4.3 Assisted Living of Part 4, Other Health Care Facilities, incorporated by reference and obtainable from the American Institute of Architects, 1735 New York Ave., N.W., Washington, D.C. 20006-5292.

434.4 Additional physical plant requirements for assisted living facilities. In addition to the codes and standards referenced in Section 434.3 of the code, the following minimum essential facilities shall apply to all new assisted living facilities.

434.4.1 Indoor radon testing as mandated by Section 404.056(5), *Florida Statutes*, shall be completed by all facilities.

434.4.2 Heating and cooling.

434.4.2.1 When outside temperatures are 65°F (18°C) or below, an indoor temperature of at least 72°F (22°C)

shall be maintained in all areas used by residents during hours when residents are normally awake. During night hours when residents are asleep, an indoor temperature of at least 68°F (20°C) shall be maintained.

434.4.2.2 During hours when residents are normally awake, mechanical cooling devices, such as electric fans, must be used in those areas of buildings used by residents when inside temperatures exceed 85°F (29°C) provided outside temperatures remain below 90°F (32°C). No residents shall be in any inside area that exceeds 90°F (32°C). However, during daytime hours when outside temperatures exceed 90°F (32°C), and at night, an indoor temperature of no more than 81°F (27°C) must be maintained in all areas used by residents.

434.4.2.3 Residents who have individually controlled thermostats in their bedrooms or apartments shall be permitted to control temperatures in those areas.

434.4.3 Common areas.

434.4.3.1 A minimum of 35 square feet (3 m^2) of living and dining space per resident, live-in staff and livein family member shall be provided except in facilities comprised of apartments. This space shall include living, dining, recreational or other space designated accessible to all residents, and shall not include bathrooms, corridors, storage space or screened porches which cannot be adapted for year round use. Facilities with apartments may count the apartment's living space square footage as part of the 35 square footage (3 m^2) living and dining space requirement.

Those facilities also serving as adult day care centers must provide an additional 35 square feet (3 m^2) of living and dining space per adult day care client. Excess floor space in residents' bedrooms or apartments cannot be counted toward meeting the requirement of 35 square feet (3 m^2) of living and dining space requirements for adult day care participants. Day care participants may not use residents' bedrooms for resting unless the room is currently vacant.

434.4.3.2 A room, separate from resident bedrooms, shall be provided where residents may read, engage in socialization or other leisure time activities. Comfortable chairs or sofas shall be provided in this communal area.

434.4.3.3 The dining area shall be furnished to accommodate communal dining.

434.4.4 Bedrooms.

434.4.4.1 Resident sleeping rooms designated for single occupancy shall provide a minimum inside measurement of 80 square feet of usable floor space. Usable floor space does not include closet space or bathrooms.

434.4.4.2 Resident bedrooms designated for multiple occupancy shall provide a minimum inside measurement of 60 square feet (6 m^2) of usable floor space per room occupant.

434.4.4.3 Resident bedrooms designated for multiple occupancy in facilities newly licensed or renovated six months after October 17, 1999, shall have a maximum occupancy of two persons.

434.4.4.4 All resident bedrooms shall open directly into a corridor, common use area or to the outside. A resident must be able to exit his bedroom without having to pass through another bedroom unless the two rooms have been licensed as one bedroom.

434.4.4.5 All resident bedrooms shall be for the exclusive use of residents. Live-in staff and their family members shall be provided with sleeping space separate from the sleeping and congregate space required for residents.

434.4.5 Bathrooms.

434.4.5.1 There shall be at least one bathroom with one toilet and sink per six persons, and one bathtub or shower per eight persons. All residents, all live-in staff and family members, and respite care participants must be included when calculating the required number of toilets, sinks, bathtubs and showers. All adult day care participants shall be included when calculating the required number of toilets and sinks.

434.4.5.2 Each bathroom shall have a door in working order to assure privacy. The entry door to bathrooms with a single toilet shall have a lock which is operable from the inside by the resident with no key needed. A nonlocking door shall be permitted if the resident's safety would otherwise be jeopardized.

434.4.5.3 There shall be nonslip safety devices such as bath mats or peel off stickers in the showers and bathtubs of all facilities. Showers and bathtubs with a nonskid surface require a separate nonskid device only if the surface is worn. Grab bars shall be required in showers and bathtubs. Grab bars, whether portable or permanent, must be securely affixed to the floor or adjoining walls. Facilities newly licensed or renovated six months after October 17, 1999 must have grab bars next to the commode.

434.4.5.4 Sole access to a toilet or bathtub or shower shall not be through another resident's bedroom, except in apartments within a facility.

434.4.6 Security. External boundaries of a facility or a distinct part of a facility, including outside areas, may be secured using egress control or perimeter control devices if the following conditions are met.

434.4.6.1 The use of the device complies with all lifesafety requirements.

434.4.6.2 Residents residing within a secured area are able to move freely throughout the area, including the resident's bedroom or apartment, bathrooms and all common areas, and have access to outdoor areas on a regular basis and as requested by each resident.

434.4.6.3 Residents capable of entering and exiting without supervision have keys, codes or other mechanisms to exit the secured area without requiring staff assistance.

434.4.6.4 Staff who provide direct care or who have regular contact with residents residing in secured areas com-

plete Level 1 Alzheimer's training as described in Rule 58A-5.0191.

434.4.6.5 Pursuant to Section 400.441, *Florida Statutes*, facilities with 16 or fewer residents shall not be required to maintain an accessible telephone in each building where residents reside, maintain written staff job descriptions, have awake night staff or maintain standardized recipes as provided in Rules 58A-5.0182(6)(g), 58A-5.019(2)(e), 58A-5.019(4)(a) and 58A-5.020(2)(b), respectively.

434.5 Extended congregate care.

434.5.1 Physical site requirements. Each extended congregate care facility shall provide a homelike physical environment which promotes resident privacy and independence including:

434.5.1.1 A private room or apartment, or a semiprivate room or apartment shared with roommate of the resident's choice. The entry door to the room or apartment shall have a lock which is operable from the inside by the resident with no key needed. The resident shall be provided with a key to the entry door on request. The resident's service plan may allow for a nonlocking entry door if the resident's safety would otherwise be jeopardized.

434.5.1.2 A bathroom, with a toilet, sink and bathtub or shower, which is shared by a maximum of four residents. A centrally located hydromassage bathtub may substitute for the bathtub or shower in two of the bath rooms. The entry door to the bathroom shall have a lock which is operable from the inside by the resident with no key needed. The resident's service plan may allow for a nonlocking bathroom door if the resident's safety would otherwise be jeopardized.

SECTION 435
CONTROL OF RADIATION HAZARDS

435.1 Scope. Control of radiation hazards shall comply with the following design and construction standards as described herein.

Note: Other administrative and programmatic provisions may apply. See Department of Health (DOH) Rule 64E-5, *Florida Administrative Code*, and Chapter 404, *Florida Statutes*.

435.2 Control of access to high radiation areas.

435.2.1 Definitions.

HIGH RADIATION AREA. An area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 1 mSv (0.1 rem) in 1 hour at 30 cm from any source of radiation or from any surface that the radiation penetrates. For purposes of this section, rooms or areas in which diagnostic X-ray systems are used for healing arts purposes are not considered high radiation areas.

VERY HIGH RADIATION AREA. An area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess to 500 rad (5 gray) in 1 hour at 1 m from a source of radiation or from any surface that the radiation penetrates. At very high doses received at high dose rates, units of absorbed dose, gray and rad, are appropriate, rather than units of dose equivalent, sievert and rem.

435.2.2 The licensee or registrant shall ensure that each entrance or access point to a high radiation area has one or more of the following features:

435.2.2.1 A control device that upon entry into the area causes the level of radiation to be reduced below that level at which an individual might receive a deep dose equivalent of 0.1 rem (1 millisievert) in 1 hour at 30 cm from the source of radiation from any surface that the radiation penetrates;

435.2.2.2 A control device that energizes a conspicuous visible or audible signal so that the individual entering the high radiation area and the supervisor of the activity are made aware of the entry; or

435.2.2.3 Entryways that are locked except during periods when access to the areas is required with positive control over each individual entry.

435.3 Caution signs.

435.3.1 Standard radiation symbol. Unless otherwise authorized by the department, the symbol prescribed in this section shall use the colors magenta or purple or black on yellow background. The symbol prescribed is the three-bladed design as follows:

435.3.1.1 Radiation symbol.

435.3.1.1.1 Cross-hatched area is to be magenta or purple or black.

435.3.1.1.2 The background is to be yellow.

435.3.2 Exception to color requirements for standard radiation symbol. In spite of the requirements of Section 435.3.1, licensees or registrants are authorized to label sources, source holders or device components containing sources of radiation that are subjected to high temperatures, with conspicuously etched or stamped radiation caution symbols and without a color requirement.

435.3.3 Additional information on signs and labels. In addition to contents of signs and labels prescribed in this part, the licensee or registrant shall provide on or near the required signs and labels additional information to make individuals aware of potential radiation exposures and to minimize the exposures.

435.4 Posting requirements.

435.4.1 Posting of radiation areas. The licensee or registrant shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIATION AREA."

435.4.2 Posting of high radiation areas. The licensee or registrant shall post each high radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, HIGH RADIATION AREA" or "DANGER, HIGH RADIATION AREA."

435.4.3 Posting of very high radiation areas. The licensee or registrant shall post each very high radiation area with a conspicuous sign or signs bearing the radiation symbol and words "GRAVE DANGER, VERY HIGH RADIATION AREA."

435.4.4 Posting of air-borne radioactivity areas. The licensee shall post each air-borne radioactivity area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, AIR-BORNE RADIOACTIVITY AREA" or "DANGER, AIR-BORNE RADIOACTIVITY AREA."

435.4.5 Posting of areas or rooms in which licensed material is used or stored. The licensee shall post each area or room in which there is used or stored an amount of licensed material exceeding 10 times the quantity of such material specified in State of Florida Office of Radiation Control Radioactive Material Requiring Labeling, May 2000, which is herein incorporated by reference and which is available from the department, with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)."

435.4.6 A licensee or registrant is not required to post caution signs in areas or rooms containing sources of radiation for periods of less than 8 hours if each of the following conditions is met.

435.4.6.1 The sources of radiation are constantly attended during these periods by an individual who takes the precautions necessary to prevent the exposure of individuals to sources of radiation in excess of the limits established in this section, and

435.4.6.2 The area or room is subject to the licensee's or registrant's control.

435.4.7 Rooms or other areas in hospitals that are occupied by patients are not required to be posted with caution signs as specified in 64E-5.323 if the patient could be released from confinement as specified in 64E-5.622.

435.4.8 A room or area is not required to be posted with a caution sign because of the presence of a sealed source provided the radiation level at 30 cm from the surface of the sealed source container or housing does not exceed 0.005 rem (0.05 millisievert) per hour.

435.4.9 A room or area is not required to be posted with a caution sign because of the presence of radiation machines used solely for diagnosis in the healing arts.

435.5 General requirements.

435.5.1 Shielding. Each X-ray facility shall have primary and secondary protective barriers as needed to assure that an individual will not receive a radiation dose in excess of the limits specified in Part III of Chapter 64E-5, *Florida Administrative Code*.

435.5.1.1 Structural shielding in walls and other vertical barriers required for personnel protection shall extend without breach from the floor to a height of at least 7 feet (2.1 m).

435.5.1.2 Doors, door frames, windows and window frames shall have the same lead equivalent shielding as that required in the wall or other barrier in which they are installed.

435.5.1.3 Prior to construction, the floor plans and equipment arrangement of all new installations, or modifications of existing installations, utilizing X-ray energies of 200 keV and above for diagnostic or therapeutic purposes shall be submitted to the Department of Health for review and approval. In computation of protective barrier requirements, the maximum anticipated workload, use factors, occupancy factors and the potential for radiation exposure from other sources shall be taken into consideration.

435.5.1.3.1 The plans shall show, as a minimum, the following:

435.5.1.3.1.1 The normal location of the X-ray system's radiation port; the port's travel and traverse limits; general direction of the useful beam; locations of any windows and doors; the location of the operator's booth; and the location of the X-ray control panel.

435.5.1.3.1.2 The structural composition and thickness or lead equivalent of all walls, doors, partitions, floor and ceiling of the room concerned.

435.5.1.3.1.3 The dimensions of the room concerned.

435.5.1.3.1.4 The type of occupancy of all adjacent areas inclusive of space above and below the room concerned. If there is an exterior wall, the distance to the closest area where it is likely that individuals may be present.

435.5.1.3.1.5 The make and model of the X-ray equipment and the maximum technique factors.

435.5.1.3.1.6 The type of examinations or treatments which will be performed with the equipment.

435.5.1.3.2 Information shall be submitted on the anticipated maximum workload of the X-ray system.

435.5.1.3.3 If the services of a qualified person have been utilized to determine the shielding requirements, a copy of the report, including all basic assumptions used, shall be submitted with the plans.

435.5.2 X-ray film processing facilities.

435.5.2.1 Processing facilities. Each installation using a radiographic X-ray system shall provide suitable equipment for handling and processing radiographic film in accordance with the following provisions:

435.5.2.1.1 The area in which undeveloped films are handled for processing shall be devoid of light with the exception of light in the wave lengths having no significant effect on the radiographic film.

435.5.2.1.2 Film pass boxes, if provided, shall be so constructed as to exclude light when film is placed in or removed from the boxes, and shall incorporate adequate shielding to prevent exposure of undeveloped film to stray radiation.

435.5.2.1.3 Darkrooms used by more than one individual shall be provided a positive method to prevent accidental entry while undeveloped films are being handled or processed.

435.5.2.1.4 Where film is developed manually, the following conditions shall be met:

435.5.2.1.4.1 At least one trisectional tank made of mechanically rigid, corrosion resistant material shall be utilized; and

435.5.2.1.4.2 The temperature of each solution shall be maintained within the range of 600°F to 800°F (160°C to 270°C). Film shall be developed in accordance with the time-temperature relationships specified by the film manufacturer, or, in the absence of such recommendations by the film manufacturer, with the following time-temperature chart:

435.5.2.1.4.3 Devices shall be utilized which will:

1. Indicate the actual temperature of the developer; and
2. Signal the passage of a preset time as short as 2 minutes.

TIME-TEMPERATURE CHART

Thermom Reading (Degrees)		Minimum Developing Time (minutes)
C	F	
26.7	80	2
26.1	79	2
25.6	78	2-1/2
25.0	77	2-1/2
24.4	76	3
23.9	75	3
23.3	74	3-1/2
22.8	73	3-1/2
22.2	72	4
21.7	71	4
21.1	70	4-1/2
20.6	69	4-1/2
20.0	68	5
19.4	67	5-1/2
18.9	66	5-1/2
18.3	65	6
17.8	64	6-1/2
17.2	63	7
16.7	62	8
16.1	61	8-1/2
15.6	60	9-1/2

435.6 Doors, interlocks, and warning systems.

435.6.1 A licensee shall control access to the teletherapy room by a door at each entrance.

435.6.2 A licensee shall equip each entrance to the teletherapy room with an electrical interlock system that shall:

1. Prevent the operator from turning on the primary beam of radiation unless each treatment room entrance door is closed;
2. Turn off the beam of radiation immediately when an entrance door is opened; and
3. Prevent the primary beam of radiation from being turned on following an interlock interruption until all treatment room entrance doors are closed and the beam on-off control is reset at the console.

435.6.3 A licensee shall equip each entrance to the teletherapy room with a conspicuously visible beam condition indicator light.

435.7 Radiation monitoring devices.

435.7.1 A licensee shall have a permanent radiation monitor in each teletherapy room capable of continuously monitoring beam status.

435.7.2 Each radiation monitor shall be capable of providing visible notice of a teletherapy unit malfunction that results in an exposed or partially exposed source. The visible indicator of high radiation levels shall be observable by an individual entering the teletherapy room.

435.7.3 Each radiation monitor shall be equipped with a backup power supply separate from the power supply to the teletherapy unit. This backup power supply may be a battery system.

435.8 Viewing systems. A licensee shall construct or equip each teletherapy room to permit continuous observation of the patient from the teletherapy unit console during irradiation.

435.9 Warning devices.

435.9.1 All locations designated as high radiation areas, and all entrances to such locations shall be equipped with easily observable warning lights that operate when and only when radiation is being produced.

435.9.2 Except in facilities designed for human exposure, each high radiation area shall have an audible warning device which shall be activated for 15 seconds prior to the possible creation of such high radiation area. Such warning device shall be clearly discernible in all high radiation areas and in any adjacent radiation areas.

435.9.3 Barriers, temporary or otherwise, and pathways leading to high radiation areas shall be identified in accordance with the Department of Health.

435.10 Design requirements for radiation rooms. Panoramic irradiators shall not be operated unless the following are met:

435.10.1 Each entrance to a radiation room must have a door or other physical barrier to prevent inadvertent entry of personnel while the sources are exposed. Product conveyor systems can serve as barriers as long as they reliably and consistently function as a barrier. It must not be possible to move the sources out of their shielded position if any door or barrier to the radiation room is open. Opening the door or barrier while the sources are exposed must cause the sources to return promptly to their shielded position. The primary entry door must have a lock which is operated by the same key used to control source movement. The doors and barriers must not prevent any individual in the radiation room from leaving.

435.10.2 Each entrance to a radiation room must have an independent backup access control to detect personnel entry while the sources are exposed if the primary access control fails. Entry while the sources are exposed must cause the sources to return to their fully shielded position and also must activate a visible and audible alarm to make the individual entering the room aware of the hazard. The alarm also must alert at least one other individual of the entry who is on site and who is trained to render or summon assistance promptly.

435.10.3 A radiation monitor must be provided to detect the presence of high radiation levels in the radiation room before personnel entry. The monitor must be integrated with personnel access door locks to prevent room access when the monitor detects high radiation levels. The monitor must generate audible and visible alarms if high radiation levels are detected when personnel entry is attempted. The monitor can be located in the entrance or maze but not in the direct radiation beam.

435.10.4 Before sources move from their shielded position, the source control automatically must activate conspicuous visible and audible alarms to alert people in the radiation room that the sources will be moved from their shielded position. The alarms must give individuals enough time to leave the room before the sources leave the shielded position.

435.10.5 Each radiation room must have a clearly visible and readily accessible control which will allow an individual in the room to return the sources to their fully shielded position.

435.10.6 Each radiation room must contain a control which allows the sources to move from the shielded position only if the control has been activated and the door or barrier to the radiation room subsequently has been closed within a preset time.

435.10.7 Each entrance to the radiation room and each entrance to the area within the personnel access barrier of an underwater irradiator must be posted as required by this section. Panoramic irradiators also must be posted as required by this section. The sign can be removed, covered or otherwise made inoperative when the sources are shielded fully.

435.10.8 If the radiation room has roof plugs or other movable shielding, it must not be possible to operate the irradiator unless the shielding is in its proper location. This requirement can be met by interlocks which prevent operation if shielding is not placed properly or by an operating procedure requiring inspection of shielding before operating.

435.10.9 Underwater irradiators must have a personnel access barrier around the pool which must be locked to prevent access when the irradiator is not attended. Only operators and facility management shall have access to keys to the personnel access barrier. There must be an intrusion alarm to detect unauthorized entry when the personnel access barrier is locked. Activation of the intrusion alarm must alert an individual, not necessarily on site, who is prepared to respond or summon assistance.

435.11 Fire protection.

435.11.1 The radiation room at a panoramic irradiator must have heat and smoke detectors. The detectors must activate an audible alarm. The alarm must be capable of alerting a person who is prepared to summon assistance promptly. The sources must become fully shielded automatically and the air handling systems within the radiation room must be disabled automatically if a fire is detected.

435.11.2 The radiation room at a panoramic irradiator must be equipped with a fire suppression or extinguishing system capable of extinguishing a fire without the entry of personnel into the room. The system for the radiation room must have a shutoff valve to control flooding into unrestricted areas.

435.12 Irradiator pools.

435.12.1 Irradiator pools must possess a watertight stainless steel liner or a liner metallurgically compatible with other components in the pool or be constructed so that there is a low likelihood of substantial leakage and have a surface designed to facilitate decontamination and must include a means of safely storing sources during repairs of the pool.

435.12.2 Irradiator pools must have no penetration more than 0.5 m below the normal low water level which could allow water to drain out of the pool. Pipes which have intakes more than 0.5 m below the normal low water level must have siphon breakers to prevent the siphoning of the pool.

435.12.3 A means must be provided to replenish water losses from the pool.

435.12.4 An audible and visible indicator must be provided to indicate if the pool water level is below the normal low water level or above the normal high water level.

435.12.5 Irradiator pools must be equipped with a purification system designed to maintain the water during normal operation at a level of conductance not exceeding 20 microsiemens per centimeter and with a clarity so the sources can be seen clearly.

435.12.6 A physical barrier such as a railing or cover must be used around irradiator pools during normal operation to prevent personnel from accidentally falling into the pool.

The barrier can be removed during maintenance, inspection, and service operations.

435.12.7 If long-handled tools or poles are used in irradiator pools, the radiation dose rate on the handling areas of the tools must not exceed 2 millirem (0.02 millisievert) per hour.

435.13 Design requirements.

435.13.1 Panoramic irradiators shall meet the following design requirements:

435.13.1.1 Shielding. The shielding walls shall be designed to meet generally accepted building code requirements for reinforced concrete and shall design the walls, wall penetrations, and entrance ways to meet the radiation shielding requirements of 64E-5.1407. If the irradiator will use more than 2×10^{17} becquerels (5 million curies) of activity, the licensee shall evaluate the effects of heating of the shielding walls by the irradiator sources.

435.13.1.2 Foundations. The foundation shall be designed with consideration given to soil characteristics to ensure it is adequate to support the weight of the facility.

435.13.1.3 Fire protection. The number, design, locations and spacing of the smoke and heat detectors and extinguishing system shall be appropriate to detect fires and that the detectors are protected from mechanical and radiation damage. The fire extinguishing system shall be designed to provide the necessary discharge patterns, densities, and flow characteristics for complete coverage of the radiation room and that the system is protected from mechanical and radiation damage.

435.13.1.4 Wiring. The electrical wiring and electrical equipment in the radiation room shall be selected to minimize failures due to prolonged exposure to radiation.

435.13.2 Pool irradiators shall meet the following design requirements.

435.13.2.1 Pool integrity. The pool shall be designed to assure that it is leak resistant, that it is strong enough to bear the weight of the pool water and shipping casks, that a dropped cask would not fall on sealed sources, that all penetrations meet the requirements of Section 435.12.2, and that metal components are metallurgically compatible with other components in the pool.

435.13.2.2 Water-handling system. The water purification system shall be designed to meet the requirements of Section 435.12.5. The system must be designed so that water leaking from the system does not drain to unrestricted areas without being monitored. The licensee shall design the water chiller system so that it shall compensate adequately for the amount of heat generated by the sealed sources. The water-handling system must have remote controls capable of safely operating a contaminated system.

435.13.3 Floor penetrations. No floor penetrations, including expansion joints, floor joints and drains, shall allow the uncontrolled release of water from the radiation room that has not been analyzed for its radioactive content.

435.14 Construction control. The requirements of this section must be met before loading sources. Panoramic irradiators shall meet the following construction requirements:

435.14.1 Shielding. The construction of the shielding shall be monitored to verify that it meets design specifications and generally accepted building code requirements for reinforced concrete.

435.14.2 Foundations. The construction of the foundations shall be monitored to verify that they meet design specifications.

435.14.3 Fire protection. The ability of the heat and smoke detectors shall be verified to detect a fire, to activate alarms and to cause the source rack to become fully shielded automatically. The operability of the fire suppression or extinguishing system shall also be verified

435.14.4 Wiring. The electrical wiring and electrical equipment that were installed shall be verified to meet the design specifications.

435.15 Pool irradiators shall meet the following construction requirements.

435.15.1 Pool integrity. The integrity of the pool shall be tested to verify that the pool meets the design specifications. The penetrations and water intakes shall be verified to meet the requirements of Section 435.12.2

SECTION 436
DAY-CARE OCCUPANCIES

436.1 General.

436.1.1 Places of religious worship shall not be required to meet the provisions of this section in order to operate a nursery while services are being held in the building.

436.1.2 Where day care occupancies with clients 24 months or less in age or incapable of self-preservation are located one or more stories above the level of exit discharge or where day care occupancies are located two or more stories above the level of exit discharge, smoke barriers shall be provided to divide such stories into a minimum of two smoke compartments. The smoke barriers shall be constructed in accordance with Section 709 but shall not be required to have a fire-resistance rating.

436.2 Closet doors. Every closet door latch shall be such that clients can open the door from inside the closet.

436.3 Bathroom doors. Every bathroom door lock shall be designed to permit opening of the locked door from the outside in an emergency. The opening device shall be readily accessible to the staff.

436.4 Door closure. Any exit door designed to be normally closed shall be kept closed and shall comply with Section 715.3.

436.5 Location and construction types. Day care occupancies shall be limited to the locations and construction types specified in Table 436.5. Day care homes and adult day care shall be permitted to be of any type construction permitted by this code.

TABLE 436.5
DAY-CARE LOCATION AND TYPE OF CONSTRUCTION

LOCATION OF DAY CARE	TYPE OF CONSTRUCTION	
	Sprinklered Building	Construction Type
1 story below LED[1]	Yes	I, II, IIIA, IV, V-A
Level of Exit Discharge	No	Any type permitted by this code
1 story above LED[1]	Yes No	Any type
2 or 3 stories above LED[1]	Yes	I, II, III-A, V-A
> 3 stories above LED[1] but not high rise	Yes	I
High rise	Yes	I

Notes:
[1]LED means Level of Exit Discharge.

436.6 Protection from hazards. Rooms or spaces for the storage, processing or use of materials specified below shall be protected in accordance with the following:

436.6.1 The following rooms or spaces shall be separated from the remainder of the building by fire barriers having a fire resistance rating of not less than 1-hour or shall be protected by an approved automatic extinguishing system.

1. Boiler and furnace rooms.

   Exception: Rooms enclosing only air-handling equipment.

2. Rooms or spaces used for the storage of combustible supplies in quantities deemed hazardous by the building official.
3. Rooms or spaces used for the storage of hazardous materials or flammable or combustible liquids in quantities deemed hazardous by recognized standards.
4. Janitor closets.

   Exception: Doors to janitor closets shall be permitted to have ventilating louvers where the space is protected by automatic sprinklers.

436.6.2 The following rooms or spaces shall be separated from the remainder of the building by fire barriers having a fire resistance rating of not less than 1 hour and shall be protected by an approved automatic fire-extinguishing system.

1. Laundries.
2. Maintenance shops, including woodworking and painting areas.
3. Rooms or spaces used for processing or use of combustible supplies deemed hazardous by the building official.
4. Rooms or spaces used for processing or use of hazardous materials or flammable or combustible liquids in quantities deemed hazardous by recognized standards.

Exception: Food preparation facilities protected in accordance with NFPA 96 shall not be required to have openings protected between food preparation areas and dining areas. Where domestic cooking equipment is used for food warming or limited cooking, protection or segregation of food preparation facilities shall not be required if approved by the building official.

436.6.3 Where automatic extinguishing is used to meet the requirements of this section, sprinkler piping serving not more than six sprinklers for any isolated hazardous area shall be permitted to be connected directly to a domestic water supply system having a capacity sufficient to provide 0.15 gpm/per square foot (6.1 L/min/m^2) of floor area throughout the entire enclosed area. An indicating shutoff valve shall be installed in an accessible location between the sprinklers and the connection to the domestic water supply.

436.7 Detection and alarm systems. Day care occupancies shall be provided with a fire alarm system in accordance with Section 907 and this section.

Exception: Day care occupancies housed in one room.

436.7.1 Initiation of the required fire alarm system shall be by manual means and by operation of any required smoke detectors and required sprinkler systems.

436.7.1.1 Occupant notification signals shall be audible and visual signals in accordance with NFPA 72 and Chapter 11 of this code. The general evacuation alarm signal shall operate throughout the entire building.

Exceptions:

1. Where total evacuation of occupants is impractical because of building configuration, only the occupants in the affected zones shall be initially notified. Provisions shall be made to selectively notify occupants in other zones to afford orderly evacuation of the entire building.
2. Where occupants are incapable of evacuating themselves because of age, physical or mental disability or physical restraint, the private operating mode as described in NFPA 72 shall be permitted to be used. Only the attendants and other personnel required to evacuate occupants from a zone, area, floor, or building shall be required to be notified. This notification shall

include means to readily identify the zone, area, floor or building in need of evacuation.

436.7.1.2 Fire department notification. The fire alarm system shall be arranged to transmit the alarm automatically to the fire department in accordance with NFPA 72 by means of one of the following methods as approved by the building official:

1. An auxiliary alarm system, or
2. A central station connection, or
3. A proprietary system, or
4. A remote station connection.

Exception: Where none of the above means of notification is available, a plan for notification of the fire department, acceptable to the building official, shall be provided.

436.7.2 Detection. A smoke detection system shall be installed in accordance with NFPA 72, with placement of detectors in each story in front of doors to the stairways and in the corridors of all floors occupied by the day care occupancy. Detectors also shall be installed in lounges, recreation areas and sleeping rooms in the day care occupancy.

Exception: Day care occupancies housed in one room.

436.8 Corridors. Every interior corridor shall be constructed of walls having not less than a 1-hour fire-resistance rating.

Exceptions:

1. In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Sections 901.6 and 903.3.1.1 corridor walls shall not be required to be rated, provided that such walls form smoke partitions in accordance with Section 710.
2. Where the corridor ceiling is an assembly having an 1-hour fire-resistance rating where tested as a wall, the corridor walls shall be permitted to terminate at the corridor ceiling.
3. Lavatories in unsprinklered buildings shall not be required to be separated from corridors, provided that they are separated from all other spaces by walls having not less than a 1-hour fire-resistance rating in accordance with Section 709.
4. Lavatories shall not be required to be separated from corridors, provided the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Sections 901.6 and 903.3.1.1.

436.9 Flexible plan and open plan buildings. Flexible plan and open plan buildings shall comply with the requirements of this chapter as modified as follows:

436.9.1 Each room occupied by more than 300 persons shall have two or more means of egress entering into separate atmospheres. Where three or more means of egress are required, not more than two of them shall enter into a common atmosphere.

436.9.2 Flexible plan buildings shall be evaluated while all folding walls are extended and in use as well as when they are in the retracted position.

436.10 Day care homes.

436.10.1 This section establishes life safety requirements for day care homes in which more than three but not more than 12 clients receive care, maintenance and supervision by other than their relative(s) or legal guardian(s) for less than 24 hours per day.

Exception: Facilities that supervise clients on a temporary basis with a parent or guardian in close proximity.

436.10.2 Definitions. For definitions, see Chapter 2.

436.10.3 Places of religious worship shall not be required to meet the provisions of this section in order to operate a nursery while services are being held in the building.

436.10.4 Occupancies that include part-day preschools, kindergartens and other schools whose purpose is primarily educational even though the children are of preschool age shall comply with the provisions for Group E occupancy.

436.10.5 Smoke detection systems.

436.10.5.1 Single-station smoke alarms installed in accordance with the household fire warning equipment requirements of Chapter 2 of NFPA 72 shall be installed within day care homes.

Exception: System smoke detectors installed in accordance with NFPA 72 and arranged to function in the same manner shall be permitted.

436.10.5.2 Where the day care home is located within a building of another occupancy, any corridors serving the day care home shall be provided with a complete smoke detection system installed in accordance with NFPA 72.

436.10.5.3 Single-station smoke alarms shall be powered by the building electrical system.

436.10.5.4 Single-station smoke alarms shall be provided in all rooms used for sleeping.

436.10.5.5 Where two or more smoke alarms are required within a living unit, suite of rooms, or similar area, they shall be arranged so that operation of any smoke alarm shall cause all smoke alarms within the living unit, suite of rooms or similar area to sound.

436.10.5.5.1 The alarms shall sound only within an individual living unit, suite of rooms or similar area and shall not actuate the building fire alarm system. Remote annunciation shall be permitted.

SECTION 437
HOSPICE INPATIENT FACILITIES AND UNITS AND HOSPICE RESIDENCES

437.1 Scope. All hospice inpatient facilities and units and residences shall comply with the following design and construction standards. Enforcement and interpretation of these provisions shall be by the state agency authorized by Section 553.73, *Florida Statutes.*

Note: Other administrative and programmatic provisions may apply. See Department of Elder Affairs (DOEA) Rule 58A-2, *Florida Administrative Code*, Agency for Health Care Administration (AHCA) Rule 59C-1, *Florida Administrative Code, and Chapter 400 Part VI, Florida Statutes*.

437.2 Physical plant requirements (inpatient facility and unit).

437.2.1 As used in this rule, "inpatient facility and unit" means the location where inpatient services are provided to hospice patients that are in need of hospice inpatient care.

437.2.2 Codes and standards.

437.2.2.1 All new inpatient units and facilities, and additions or renovations to existing units and facilities shall be in compliance with the requirements for:

1. Institutional Occupancy – Group I-2, as described in Section 308.3 of this code; and
2. The National Fire Protection Association Life Safety Code 101, Chapter 18, New Health Care Occupancy, as described in Rule 69A-3.012, F.A.C., Standards of the National Fire Protection Association and incorporated by reference in Rule 69A-3.012, F.A.C.

437.2.2.2 All new inpatient sleeping rooms shall be made accessible and shall comply with the requirements of the *Florida Building Code*, Section11-6.1(1).

437.2.2.3 In renovations and additions to existing facilities, only that portion of the total facility affected by the project must comply with applicable sections of the codes for new facilities and units.

437.2.2.4 Existing portions of the facility that are not included in the renovation or addition but are essential to the functioning of the complete facility, as well as existing areas which receive less than substantial amounts of new work, shall comply with the applicable sections of the codes for existing inpatient facilities and units.

437.2.2.5 All existing inpatient facilities and units licensed by the Agency for Health Care Administration shall be in compliance with National Fire Protection Association Life Safety Code 101, Chapter 19, Existing Health Care Occupancy, and incorporated by reference in Rule 69A-3.012, F.A.C.

437.2.3 Construction requirements. The following shall be provided in each inpatient facility and unit:

437.2.3.1 Each patient sleeping room shall have a minimum room area exclusive of toilet room, or permanently attached or built in closets, lockers or wardrobes, of 100 square feet (9.29 m^2) per bed for private rooms and 80 square feet (7.70 m^2) per bed for double occupancy rooms.

437.2.3.2 Each patient sleeping room shall have a window or door with a clear glass light in compliance with Section 1205.2 of the *Florida Building Code*. The window or door shall open directly to an atrium or to the outside of the building with a minimum of 20 feet (6.10 m) in clear and unobstructed vista measured perpendicularly from the window or door.

437.2.3.3 Each patient sleeping room shall have a wardrobe, locker or closet suitable for hanging clothing of the patient.

437.2.3.4 Other than a patient sleeping room located in a hospital or nursing home, each patient sleeping room shall have access to a toilet room without having to enter the general corridor area. One toilet room shall serve no more than four beds and no more than two resident rooms. The door shall be side hinged, swing out from the toilet room, and unless otherwise required by this code, be at least 32 inches (813 mm) wide. The toilet room shall contain a water closet with grab bars on both sides and an emergency nurse call station. The water closet shall be equipped with a bedpan-rinsing device.

437.2.3.5 A hand washing facility shall be provided within each patient toilet room or within each patient bedroom.

437.2.3.6 A nurses' station, clean workroom and soiled workroom shall be provided. Access to these rooms shall be from a corridor or ante room.

437.2.3.7 A charting space for clinical staff shall be provided at each nurses' station.

437.2.3.8 A hand washing facility shall be located in or near each nurses' station.

437.2.3.9 The clean workroom shall be provided with a work counter, hand wash facility, storage facilities and covered waste receptacle.

437.2.3.10 The soiled workroom shall be provided with a service sink equipped with rinsing device, work counter, a hand-washing facility, storage facilities, covered waste receptacle and covered linen receptacle.

437.2.3.11 A drug distribution system shall be provided with provisions for the locked storage of medications. Nothing in this section shall prohibit the use of the clean workroom for drug distribution.

437.2.3.12 A clean linen storage room or closet shall be provided.

437.2.3.13 A nourishment station with equipment for preparing or serving nourishments between scheduled meals shall be provided and shall be available for patient, family, volunteers, guests and staff use. Provisions shall be made for the use and storage of small appliances such as coffee makers or toasters. A minimum of two duplex receptacles connected to a small appliance circuit shall be provided.

437.2.3.14 A nurse calling system accessible by the patient shall be provided.

437.2.3.15 Storage for administrative supplies shall be provided.

437.2.3.16 Parking for stretchers and wheelchairs in an area out of the path of normal traffic and of adequate size for the unit shall be provided.

437.2.3.17 A janitor's closet with a floor drain and storage space for housekeeping equipment and supplies shall be provided.

437.2.3.18 A multipurpose lounge suitable and furnished for reception, recreation, dining, visitation, group social activities and worship shall be provided.

437.2.3.19 A conference or consultation room for patient and family use shall be provided.

437.2.3.20 A washer and dryer for patients' personal use shall be provided.

437.2.4 Details.

437.2.4.1 Fixtures, such as drinking fountains, public telephone, vending machines and portable equipment, shall not be located or stored so as to restrict corridor traffic or reduce the minimum required corridor width.

437.2.4.2 Doors to patient tub rooms, showers and water closets that swing into the room shall be equipped with reversible hardware that will allow the door to swing out in an emergency.

437.2.4.3 Doors, except those to closets or spaces not subject to occupancy, shall not swing into the exit access corridors.

437.2.4.4 Windows and outer doors, if used for ventilation, shall be equipped with insect screens.

437.2.4.5 Interior thresholds and expansion joint covers shall be made flush with the floor surface.

437.2.4.6 Grab bars shall be provided at all patient toilets, showers, and tubs. The bars shall have a clearance of $1^1/_2$ inches (38 mm) to the walls and shall be sufficiently anchored to sustain a concentrated applied load of not less than 250 pounds (113 kg).

437.2.4.7 Single paper towel dispensers, soap dispensers and covered waste receptacles shall be provided at all hand washing facilities.

437.2.4.8 Staff hand washing facilities shall be fitted with wrist blades and a gooseneck type spout.

437.2.4.9 All hand washing facilities shall be securely anchored to withstand an applied vertical load of not less than two hundred and fifty pounds on the front of the fixture.

437.2.5 Elevators. In new multistory units and facilities an elevator shall be provided in compliance with the requirements of Chapter 30 of the *Florida Building Code, Building*. In addition, a hospital-type elevator large enough to accommodate a bed and attending staff shall service all patient sleeping rooms and patient treatment areas located above the ground floor. The car shall be at least 5 feet 8 inches (1.73 m) wide by 9 feet (2.74 m) deep and the car doors shall have a clear opening of not less than 4 feet (1.22 m) wide and 7 feet (2.13 m) high.

437.2.6 Mechanical system requirements.

437.2.6.1 Air conditioning, heating and ventilating systems.

1. All patient occupied areas shall be heated or cooled by individual or central units. Heating units shall be designed to provide a minimum of 72°F (22.22°C) ambient indoor temperature and air conditioning units shall be designed to provide a minimum of 78°F (25.55°C) ambient indoor temperature.
2. All air-supply and air-exhaust systems shall be mechanically operated. Fans serving exhaust systems shall be located at the discharge end of the system.

437.2.6.2 Plumbing and other piping systems. Water distribution systems shall be arranged to provide hot water at each hot water outlet at all times. Hot water at shower, bathing, and hand washing facilities for patients' personal use shall not exceed 110°F (43.3°C).

437.2.7 Electrical system requirements.

437.2.7.1 Lighting.

1. All spaces occupied by people, machinery, and equipment within the building, approaches to building, and parking areas shall have electric lighting.
2. All patients' rooms shall have general lighting and night lighting. General room luminaries shall be switched at the entrance to the patient room.

437.2.7.2 Receptacles. All patient rooms shall have hospital grade duplex grounding type receptacles.

437.2.8 Emergency electrical system.

437.2.8.1 A Type 1 essential electrical system shall be provided in all hospice facilities as described in National Fire Protection Association Life Safety Code 99, "Health Care Facilities", and incorporated by reference in Rule 69A-3.012, *F.A.C.* The emergency power for this system shall meet the requirements of a Level 1, type 10, Class 48 generator as described in National Fire Protection Association Life Safety Code 110, "Emergency Standby Power Systems", and incorporated by reference in Rule 69A-3.012, *F.A.C.*

437.2.8.2 In new construction, the normal main service equipment shall be separated from the emergency distribution equipment by locating it in a separate room. Transfer switches shall be considered emergency distribution equipment for this purpose.

437.2.8.3 Switches for critical branch lighting shall be completely separate from normal switching. The devices or cover plates shall be of a distinctive color. Critical branch switches are permitted to be adjacent to normal switches. Switches for life safety lighting are not permitted except as required for dusk-to-dawn automatic control of exterior lighting fixtures.

437.2.8.4 There shall be selected life safety lighting provided at a minimum of 1 footcandle and designed for automatic dusk-to-dawn operation along the travel paths from the exits to the public way or to safe areas located a minimum of 30 feet (9.14 m) from the building.

437.2.8.5 A minimum of one elevator per bank serving any patient use floor shall be connected to the equipment branch of the essential electric system and arranged for manual or automatic operation during loss of normal power. Elevator cab lighting, controls, and communication and signal systems shall be connected to the life safety branch.

437.2.8.6 There shall be a dedicated low-fuel alarm for the day tank supplying the emergency generator driver. A manual pump shall also be provided for the day tank. The alarm shall be located at the generator derangement panel.

437.2.8.7 Transfer switch contacts shall be of the open type and shall be accessible for inspection and replacement.

437.2.8.8 If required by the facility's emergency food plan, there shall be power connected to the equipment branch of the essential electrical system for kitchen refrigerators, freezers and range hood exhaust fans. Selected lighting within the kitchen and dry storage areas shall be connected to the critical branch of the essential electrical system.

437.3 Residential units.

437.3.1 Residential units shall comply with the *Florida Building Code* and the National Fire Protection Association Life Safety Code 101 as adopted by the *Florida Fire Prevention Code.*

437.3.2 Residential units shall comply with the following codes and standards:

437.3.2.1 All new facilities and additions and renovations to existing facilities shall be in compliance with:

1. Section 310.1 of this code for Group R-4 occupancy;
2. The National Fire Protection Association Life Safety Code 101, Chapter 32, Residential Board and Care Occupancy and incorporated by reference in Rule 69A-3.012, *F.A.C.*, and
3. Chapter 11, Section 11-6.1(1) of the *Florida Building Code, Building.*

437.3.2.2 All existing facilities shall comply with National Fire Protection Association Life Safety Code 101, Chapter 33, Residential Board and Care Occupancy and incorporated by reference in Rule 69A-3.012, *F.A.C.*

SECTION 438
GROUP I-1, R-1, R-2, R-3

438.1 General. Occupancies in Groups I-1, R-1, R-2 and R-3 shall comply with the provisions of this section and other applicable provisions of this code.

438.2 Separation walls. Walls separating dwelling units in the same building and walls separating sleeping units in the same building shall comply with Section 708.

438.3 Horizontal separation. Floor/ceiling assemblies separating dwelling units in the same buildings and floor/ceiling assemblies separating sleeping units in the same building shall be constructed in accordance with Section 711.

SECTION 439
HYDROGEN CUTOFF ROOMS

[F] 439.1 General. When required by the *Florida Fire Prevention Code*, hydrogen cutoff rooms shall be designed and constructed in accordance with this section.

[F] 439.2 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

[F] GASEOUS HYDROGEN SYSTEM. An assembly of piping, devices and apparatus designed to generate, store, contain, distribute or transport a nontoxic, gaseous hydrogen-containing mixture having at least 95-percent hydrogen gas by volume and not more than 1-percent oxygen by volume. Gaseous hydrogen systems consist of items such as compressed gas containers, reactors and appurtenances, including pressure regulators, pressure relief devices, manifolds, pumps, compressors and interconnecting piping and tubing and controls.

[F] HYDROGEN CUTOFF ROOM. A room or space that is intended exclusively to house a gaseous hydrogen system.

[F] 439.3 Location. Hydrogen cut-off rooms shall not be located below grade.

[F] 439.4 Design and construction. Hydrogen cutoff rooms shall be classified with respect to occupancy in accordance with Section 302.1 and separated from other areas of the building by not less than 1-hour fire barriers or as required by Section 508.2 or 508.3 as applicable.

[F] 439.4.1 Opening protectives. Doors within such fire barrier walls, including doors to corridors, shall be self-closing in accordance with Section 715. Interior door openings shall be electronically interlocked to prevent operation of the hydrogen system when doors are opened or ajar or the room shall be provided with a mechanical exhaust ventilation system designed in accordance with Section 439.4.1.1.

[F] 439.4.1.1 Ventilation alternative. When an exhaust system is used in lieu of the interlock system required by Section 439.4, exhaust ventilation systems shall operate continuously and shall be designed to operate at a negative pressure in relation to the surrounding area. The average velocity of ventilation at the face of the door opening with the door in the fully open position shall not be less than 60 feet per minute (0.3048 m/s) with a minimum of 45 feet per minute (0.2287 m/s) at any point in the door opening.

[F] 439.4.2 Windows. Operable windows in interior walls shall not be permitted. Fixed windows shall be permitted when in accordance with Section 715.

[F] 439.5 Ventilation. Cutoff rooms shall be provided with mechanical ventilation in accordance with the applicable provisions for repair garages in Chapter 5 of the *Florida Building Code, Mechanical.*

[F] 439.6 Gas detection system. Hydrogen cutoff rooms shall be provided with an approved flammable gas-detection system in accordance with Sections 439.6.1 through 439.6.3.

[F] 439.6.1 System design. The flammable gas-detection system shall be listed for use with hydrogen and any other flammable gases used in the room. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the lower flammability limit (LFL) for the gas or mixtures present at their anticipated temperature and pressure.

[F] 439.6.2 Operation. Activation of the gas detection system shall result in all of the following:

1. Initiation of distinct audible and visual alarm signals both inside and outside of the cutoff room.
2. Activation of the mechanical ventilation system.

[F] 439.6.3 Failure of the gas detection system. Failure of the gas detection system shall result in activation of the mechanical ventilation system, cessation of hydrogen generation and the sounding of a trouble signal in an approved location.

[F] 439.7 Explosion control. Explosion control shall be provided in accordance with the *Florida Fire Prevention Code*.

[F] 439.8 Standby power. Mechanical ventilation and gas detection systems shall be connected to a standby power system in accordance with Chapter 27.

CHAPTER 5
GENERAL BUILDING HEIGHTS AND AREAS

SECTION 501
GENERAL

501.1 Scope. The provisions of this chapter control the height and area of structures hereafter erected and additions to existing structures.

[F] 501.2 Address numbers. Buildings shall have approved address numbers, building numbers or approved building identification placed in a position that is plainly legible and visible from the street or road fronting the property. These numbers shall contrast with their background. Address numbers shall be Arabic numerals or alphabetical letters. Numbers shall be a minimum of 4 inches (102 mm) high with a minimum stroke width of 0.5 inch (12.7 mm).

SECTION 502
DEFINITIONS

502.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

AREA, BUILDING. The area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.

BASEMENT. That portion of a building that is partly or completely below grade plane (see "Story above grade plane" in Section 202). A basement shall be considered as a story above grade plane where the finished surface of the floor above the basement is:

1. More than 6 feet (1829 mm) above grade plane; or
2. More than 12 feet (3658 mm) above the finished ground level at any point.

EQUIPMENT PLATFORM. An unoccupied, elevated platform used exclusively for mechanical systems or industrial process equipment, including the associated elevated walkways, stairs and ladders necessary to access the platform (see Section 505.5).

GRADE PLANE. A reference plane representing the average of finished ground level adjoining the building at exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

HEIGHT, BUILDING. The vertical distance from grade plane to the average height of the highest roof surface.

HEIGHT, STORY. The vertical distance from top to top of two successive finished floor surfaces; and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

MEZZANINE. An intermediate level or levels between the floor and ceiling of any story and in accordance with Section 505.

SECTION 503
GENERAL HEIGHT AND AREA LIMITATIONS

503.1 General. The height and area for buildings of different construction types shall be governed by the intended use of the building and shall not exceed the limits in Table 503 except as modified hereafter. Each part of a building included within the exterior walls or the exterior walls and fire walls where provided shall be permitted to be a separate building.

503.1.1 Special industrial occupancies. Buildings and structures designed to house special industrial processes that require large areas and unusual heights to accommodate craneways or special machinery and equipment, including, among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be exempt from the height and area limitations of Table 503.

503.1.2 Buildings on same lot. Two or more buildings on the same lot shall be regulated as separate buildings or shall be considered as portions of one building if the height of each building and the aggregate area of buildings are within the limitations of Table 503 as modified by Sections 504 and 506. The provisions of this code applicable to the aggregate building shall be applicable to each building.

503.1.3 Type I construction. Buildings of Type I construction permitted to be of unlimited tabular heights and areas are not subject to the special requirements that allow unlimited area buildings in Section 507 or unlimited height in Sections 503.1.1 and 504.3 or increased height and areas for other types of construction.

503.1.4 Basements. A basement of a building shall not count as a story when applying Table 503 for allowable building height.

503.1.5 Group A and E basements. Group A and E basements used as classrooms or assembly rooms shall be counted as a story.

SECTION 504
HEIGHT

504.1 Special unlimited height. The height of Group B, M and R occupancies of Type I-B construction shall not be limited, provided the fire resistance of all columns shall be not less

TABLE 503
ALLOWABLE HEIGHT AND BUILDING AREAS[a]
Height limitations shown as stories and feet above grade plane.
Area limitations as determined by the definition of "Area, building," per story

		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
GROUP	HGT(feet) HGT(S)	UL	160	65	55	65	55	65	50	40
A-1	S	UL	5	3	2	3	2	3	2	1
	A	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
A-2	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-3	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-4	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-5	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	S	UL	11	5	4	5	4	5	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
E/D	S	UL	5	3	2	3	2	3	1	1
	A	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500
F-1	S	UL	11	4	2	3	2	4	2	1
	A	UL	UL	25,000	15,500	19,000	12,000	33,500	14,000	8,500
F-2/F-3	S	UL	11	5	3	4	3	5	3	2
	A	UL	UL	37,500	23,000	28,500	18,000	50,500	21,000	13,000
H-1	S	1	1	1	1	1	1	1	1	NP
	A	21,000	16,500	11,000	7,000	9,500	7,000	10,500	7,500	NP
H-2[d]	S	UL	3	2	1	2	1	2	1	1
	A	21,000	16,500	11,000	7,000	9,500	7,000	10,500	7,500	3,000
H-3[d]	S	UL	6	4	2	4	2	4	2	1
	A	UL	60,000	26,500	14,000	17,500	13,000	25,500	10,000	5,000
H-4	S	UL	7	5	3	5	3	5	3	2
	A	UL	UL	37,500	17,500	28,500	17,500	36,000	18,000	6,500
H-5	S	4	4	3	3	3	3	3	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
I-1	S	UL	9	4	3	4	3	4	3	2
	A	UL	55,000	19,000	10,000	16,500	10,000	18,000	10,500	4,500
I-2	S	UL	4	2	1	1	NP	1	1	NP
	A	UL	UL	15,000	11,000	12,000	NP	12,000	9,500	NP
I-3	S	UL	4	2	1	2	1	2	2	1
	A	UL	UL	15,000	10,000	10,500	7,500	12,000	7,500	5,000
M	S	UL	11	4	4	4	4	4	3	1
	A	UL	UL	21,500	12,500	18,500	12,500	20,500	14,000	9,000
R-1	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
R-2	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
R-3	S	UL	11	4	4	4	4	4	3	3
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
R-4	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
S-1	S	UL	11	4	3	3	3	4	3	1
	A	UL	48,000	26,000	17,500	26,000	17,500	25,500	14,000	9,000
S-2[b, c]	S	UL	11	5	4	4	4	5	4	2
	A	UL	79,000	39,000	26,000	39,000	26,000	38,500	21,000	13,500
U[c]	S	UL	5	4	2	3	2	4	2	1
	A	UL	35,500	19,000	8,500	14,000	8,500	18,000	9,000	5,500

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

UL = Unlimited, NP = Not permitted.

a. See the following sections for general exceptions to Table 503:

1. Section 504.2, Allowable height increase due to automatic sprinkler system installation.
2. Section 506.2, Allowable area increase due to street frontage.
3. Section 506.3, Allowable area increase due to automatic sprinkler system installation.
4. Section 507, Unlimited area buildings.

b. For open parking structures, see Section 406.3.

c. For private garages, see Section 406.1.

d. See Section 415.5 for limitations.

than 3 hours and the other structural members including floors shall be not less than that shown in Chapter 6, but in no case less than 2 hours except that roofs and their supporting beams, girders, trusses and arches shall be not less than 1½ hours.

Exception: The height of one-story aircraft hangars, aircraft paint hangars and buildings used for the manufacturing of aircraft shall not be limited if the building is provided with an automatic fire-extinguishing system in accordance with Chapter 9 and is entirely surrounded by public ways or yards not less in width than one and one-half times the height of the building.

504.2 Automatic sprinkler system increase. Where a building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the value specified in Table 503 for maximum height is increased by 20 feet (6096 mm) and the maximum number of stories is increased by one. These increases are permitted in addition to the area increase in accordance with Sections 506.2 and 506.3. For Group R buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2, the value specified in Table 503 for maximum height is increased by 20 feet (6096 mm) and the maximum number of stories is increased by one, but shall not exceed 60 feet (18 288 mm) or four stories, respectively.

Exceptions:

1. Fire areas with an occupancy in Group I-2 of Type IIB, III, IV or V construction.
2. Fire areas with an occupancy in Group H-1, H-2, H-3 or H-5.
3. Fire-resistance rating substitution in accordance with Table 601, Note h.

504.3 Roof structures. Towers, spires, steeples and other roof structures shall be constructed of materials consistent with the required type of construction of the building except where other construction is permitted by Section 1509.2.1. Such structures shall not be used for habitation or storage. The structures shall be unlimited in height if of noncombustible materials and shall not extend more than 20 feet (6096 mm) above the allowable height if of combustible materials (see Chapter 15 for additional requirements).

SECTION 505
MEZZANINES

505.1 General. A mezzanine or mezzanines in compliance with Section 505 shall be considered a portion of the story below. Such mezzanines shall not contribute to either the building area or number of stories as regulated by Section 503.1. The area of the mezzanine shall be included in determining the fire area defined in Section 702. The clear height above and below the mezzanine floor construction shall not be less than 7 feet (2134 mm).

505.2 Area limitation. The aggregate area of a mezzanine or mezzanines within a room shall not exceed one-third of the floor area of that room or space in which they are located. The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the mezzanine is located. In determining the allowable mezzanine area, the area of the mezzanine shall not be included in the floor area of the room.

Exceptions:

1. The aggregate area of mezzanines in buildings and structures of Type I or II construction for special industrial occupancies in accordance with Section 306.4 shall not exceed two-thirds of the floor area of the room.
2. The aggregate area of mezzanines in buildings and structures of Type I or II construction shall not exceed one-half of the floor area of the room in buildings and structures equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 and an approved emergency voice/alarm communication system in accordance with Section 907.2.12.2.
3. In sprinklered Group S2 occupancies of Type III construction, the enclosed and unenclosed areas under mezzanines shall be allowed to be included when calculating the permissible size of mezzanines.

505.3 Egress. Each occupant of a mezzanine shall have access to at least two independent means of egress where the common path of egress travel exceeds the limitations of Section 1014.3. Where a stairway provides a means of exit access from a mezzanine, the maximum travel distance includes the distance traveled on the stairway measured in the plane of the tread nosing. Accessible means of egress shall be provided in accordance with Section 1007.

Exception: A single means of egress shall be permitted in accordance with Section 1015.1.

505.4 Openness. A mezzanine shall be open and unobstructed to the room in which such mezzanine is located except for walls not more than 42 inches (1067 mm) high, columns and posts.

Exceptions:

1. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the occupant load of the aggregate area of the enclosed space does not exceed 10.
2. A mezzanine having two or more means of egress is not required to be open to the room in which the mezzanine is located if at least one of the means of egress provides direct access to an exit from the mezzanine level.
3. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the aggregate floor area of the enclosed space does not exceed 10 percent of the mezzanine area.
4. In industrial facilities, mezzanines used for control equipment are permitted to be glazed on all sides.
5. In other than Groups H and I occupancies no more than two stories in height above grade plane and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, a mezza-

nine having two or more means of egress shall not be required to be open to the room in which the mezzanine is located.

505.5 Equipment platforms. Equipment platforms in buildings shall not be considered as a portion of the floor below. Such equipment platforms shall not contribute to either the building area or the number of stories as regulated by Section 503.1. The area of the equipment platform shall not be included in determining the fire area. Equipment platforms shall not be a part of any mezzanine and such platforms and the walkways, stairs and ladders providing access to an equipment platform shall not serve as a part of the means of egress from the building.

505.5.1 Area limitations. The aggregate area of all equipment platforms within a room shall not exceed two-thirds of the area of the room in which they are located. Where an equipment platform is located in the same room as a mezzanine, the area of the mezzanine shall be determined by Section 505.2 and the combined aggregate area of the equipment platforms and mezzanines shall not exceed two-thirds of the room in which they are located.

[F] 505.5.2 Fire suppression. Where located in a building that is required to be protected by an automatic sprinkler system, equipment platforms shall be fully protected by sprinklers above and below the platform, where required by the standards referenced in Section 903.3.

505.5.3 Guards. Equipment platforms shall have guards where required by Section 1013.1.

SECTION 506
AREA MODIFICATIONS

506.1 General. The areas limited by Table 503 shall be permitted to be increased due to frontage (I_f) and automatic sprinkler system protection (I_s) in accordance with the following:

$$A_a = \left\{ A_t + \left[A_t \times I_f \right] + \left[A_t \times I_s \right] \right\} \qquad \textbf{(Equation 5-1)}$$

where:

A_a = Allowable area per story (square feet).

A_t = Tabular area per story in accordance with Table 503 (square feet).

I_f = Area increase factor due to frontage as calculated in accordance with Section 506.2.

I_s = Area increase factor due to sprinkler protection as calculated in accordance with Section 506.3.

506.1.1 Basements. A single basement that is not a story above grade plane need not be included in the total allowable area, provided such basement does not exceed the area permitted for a building with no more than one story above grade plane.

506.2 Frontage increase. Every building shall adjoin or have access to a public way to receive an area increase for frontage. Where a building has more than 25 percent of its perimeter on a public way or open space having a minimum width of 20 feet (6096 mm), the frontage increase shall be determined in accordance with the following:

$$I_f = \left[F / P - 0.25 \right] W / 30 \qquad \textbf{(Equation 5-2)}$$

where:

I_f = Area increase due to frontage.

F = Building perimeter that fronts on a public way or open space having 20 feet (6096 mm) open minimum width (feet).

P = Perimeter of entire building (feet).

W = Width of public way or open space (feet) in accordance with Section 506.2.1.

506.2.1 Width limits. *"W"* must be at least 20 feet (6096 mm). Where the value of W varies along the perimeter of the building, the calculation performed in accordance with Equation 5-2 shall be based on the weighted average of each portion of exterior wall and open space where the value of W is greater than or equal to 20 feet (6096 mm). Where W exceeds 30 feet (9144 mm), a value of 30 feet (9144 mm) shall be used in calculating the weighted average, regardless of the actual width of the open space.

Exception: The quantity of W divided by 30 shall be permitted to be a maximum of 2 when the building meets all requirements of Section 507 except for compliance with the 60-foot (18 288 mm) public way or yard requirement, as applicable.

506.2.2 Open space limits. Such open space shall be either on the same lot or dedicated for public use and shall be accessed from a street or approved fire lane.

506.3 Automatic sprinkler system increase. Where a building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, the area limitation in Table 503 is permitted to be increased by an additional 200 percent ($I_s = 2$) for buildings with more than one story above grade plane and an additional 300 percent ($I_s = 3$) for buildings with no more than one story above grade plane. These increases are permitted in addition to the height and story increases in accordance with Section 504.2.

Exception: The area limitation increases shall not be permitted for the following conditions:

1. The automatic sprinkler system increase shall not apply to buildings with an occupancy in Use Group H-1.
2. The automatic sprinkler system increase shall not apply to the floor area of an occupancy in Use Group H-2 or H-3. For mixed-use buildings containing such occupancies, the allowable area shall be calculated in accordance with Section 508.3.3.2, with the sprinkler increase applicable only to the portions of the building not classified as Use Group H-2 or H-3.
3. Fire-resistance rating substitution in accordance with Table 601, Note h.

506.4 Area determination. The maximum area of a building with more than one story above grade plane shall be determined by multiplying the allowable area of the first story (A_a), as determined in Section 506.1, by the number of stories above grade plane as listed below:

1. For buildings with two stories above grade plane, multiply by 2;
2. For buildings with three or more stories above grade plane, multiply by 3; and
3. No story shall exceed the allowable area per story (A_a), as determined in Section 506.1, for the occupancies on that story.

Exceptions:

1. Unlimited area buildings in accordance with Section 507.
2. The maximum area of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.2 shall be determined by multiplying the allowable area per story (A_a), as determined in Section 506.1, by the number of stories above grade plane.

506.4.1 Mixed occupancies. In buildings with mixed occupancies, the allowable area per story (A_a) shall be based on the most restrictive provisions for each occupancy when the mixed occupancies are treated according to Section 508.3.2. When the occupancies are treated according to Section 508.3.3 as separated occupancies, the maximum total building area shall be such that the sum of the ratios for each such area on all floors as calculated according to Section 508.3.3.2 shall not exceed 2 for two-story buildings and 3 for buildings three stories or higher.

SECTION 507
UNLIMITED AREA BUILDINGS

507.1 General. The area of buildings of the occupancies and configurations specified herein shall not be limited.

|| **507.2 Nonsprinklered, one story.** Reserved.

507.3 Sprinklered, one story. The area of a one-story, Group B, F, M or S building or a one-story Group A-4 building, of other than Type V construction, shall not be limited when the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

Exceptions:

1. Buildings and structures of Type I and II construction for rack storage facilities that do not have access by the public shall not be limited in height, provided that such buildings conform to the requirements of Sections 507.2 and 903.3.1.1 and NFPA 230.
2. The automatic sprinkler system shall not be required in areas occupied for indoor participant sports, such as tennis, skating, swimming and equestrian activities in occupancies in Group A-4, provided that:
   2.1. Exit doors directly to the outside are provided for occupants of the participant sports areas; and
   2.2. The building is equipped with a fire alarm system with manual fire alarm boxes installed in accordance with Section 907.
3. Group A-1 and A-2 occupancies of other than Type V construction shall be permitted, provided:
   3.1. All assembly occupancies are separated from other spaces as required for separated uses in Section 508.3.3.4 with no reduction allowed in the fire-resistance rating of the separation based upon the installation of an automatic sprinkler system;
   3.2. Each Group A occupancy shall not exceed the maximum allowable area permitted in Section 503.1; and
   3.3. All required exits shall discharge directly to the exterior.

507.4 Two story. Reserved. ||

507.5 Reduced open space. The permanent open space of 60 feet (18 288 mm) required in Sections 507.3, 507.6 and 507.10 shall be permitted to be reduced to not less than 40 feet (12 192 mm), provided the following requirements are met:

1. The reduced open space shall not be allowed for more than 75 percent of the perimeter of the building.
2. The exterior wall facing the reduced open space shall have a minimum fire-resistance rating of 3 hours.
3. Openings in the exterior wall facing the reduced open space shall have opening protectives with a minimum fire protection rating of 3 hours.

507.6 Group A-3 buildings. The area of a one-story, Group A-3 building used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court of Type II construction shall not be limited when all of the following criteria are met:

1. The building shall not have a stage other than a platform.
2. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. The assembly floor shall be located at or within 21 inches (533 mm) of street or grade level and all exits are provided with ramps complying with Section 1010.1 to the street or grade level.
4. The building shall be surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.7 Group H occupancies. Group H-2, H-3 and H-4 occupancies shall be permitted in unlimited area buildings containing Group F and S occupancies, in accordance with Sections 507.3 and 507.4 and the limitations of this section. The aggregate floor area of the Group H occupancies located at the perimeter of the unlimited area building shall not exceed 10 percent of the area of the building nor the area limitations for the Group H occupancies as specified in Table 503 as modified by Section 506.2, based upon the percentage of the perimeter of each Group H fire area that fronts on a street or other unoccupied space. The aggregate floor area of Group H occupancies not located at the perimeter of the building shall not exceed 25

percent of the area limitations for the Group H occupancies as specified in Table 503. Group H fire areas shall be separated from the rest of the unlimited area building and from each other in accordance with Table 508.3.3 For two-story unlimited area buildings, the Group H fire areas shall not be located above the first story unless permitted by the allowable height in stories and feet as set forth in Table 503 based on the type of construction of the unlimited area building.

507.8 Aircraft paint hangar. The area of a one-story, Group H-2 aircraft paint hangar shall not be limited where such aircraft paint hangar complies with the provisions of Section 412.4 and is entirely surrounded by public ways or yards not less in width than one and one-half times the height of the building.

507.9 Group E buildings. The area of a one-story Group E building of Type II, IIIA or IV construction shall not be limited when the following criteria are met:

1. Each classroom shall have not less than two means of egress, with one of the means of egress being a direct exit to the outside of the building complying with Section 1018 or the building is provided with smoke barriers having a minimum 1-hour fire-resistance rating dividing the building into areas not to exceed 30,000 square feet (2787 m^2) in floor area.
2. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. The building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.10 One-story Group A buildings without a stage requiring proscenium opening protection of Type II, III-A or IV construction which are surrounded on all sides by a permanent open space of not less than 60 feet (18.3 m), are provided with an approved automatic sprinkler system, and the assembly floor is located at or within 21 inches (533 mm) of street or grade level and all exits meet the street or grade level by ramps having a slope not exceeding a 1:12 shall not be limited in area.

507.11 Covered mall buildings and anchor stores. The area of covered mall buildings and anchor stores not exceeding three stories in height that comply with Section 402.6 shall not be limited.

SECTION 508
MIXED USE AND OCCUPANCY

508.1 General. Where a building or portion thereof contains two or more occupancies or uses, the building or portion thereof shall comply with the applicable provisions of this section.

508.2 Incidental uses. Incidental use areas shall comply with the provisions of this section.

Exception: Incidental use areas within and serving a dwelling unit are not required to comply with this section.

508.2.1 Occupancy classification. An incidental use area shall be classified in accordance with the occupancy of that portion of the building in which it is located or the building shall be classified as a mixed occupancy and shall comply with Section 508.3.

508.2.2 Separation. Incidental use areas shall be separated or protected, or both, in accordance with Table 508.2.

508.2.2.1 Construction. Where Table 508.2 requires a fire-resistance-rated separation, the incidental use area shall be separated from the remainder of the building by a fire barrier constructed in accordance with Section 706 or a horizontal assembly constructed in accordance with Section 711, or both. Where Table 508.2 permits an auto-

TABLE 508.2
INCIDENTAL USE AREAS

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic fire-extinguishing system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic fire-extinguishing system
Refrigerant machinery rooms	1 hour or provide automatic sprinkler system
Parking garage (Section 406.2)	2 hours; or 1 hour and provide automatic fire-extinguishing system
Hydrogen cut-off rooms, not classified as Group H	1-hour in Group B, F, M, S and U occupancies. 2-hour in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic fire-extinguishing system
Laboratories and vocational shops, not classified as Group H, located in Group E or I-2 occupancies	1 hour or provide automatic fire-extinguishing system
Laundry rooms over 100 square feet	1 hour or provide automatic fire-extinguishing system
Storage rooms over 100 square feet	1 hour or provide automatic fire-extinguishing system
Group I-3 cells equipped with padded surfaces	1 hour
Group I-2 waste and linen collection rooms	1 hour
Waste and linen collection rooms over 100 square feet	1 hour or provide automatic fire-extinguishing system
Stationary storage battery systems having a liquid capacity of more than 100 gallons used for facility standby power, emergency power or uninterrupted power supplies	1-hour in Group B, F, M, S and U occupancies. 2-hour in Group A, E, I and R occupancies.

For SI: 1 square foot = 0.0929 m^2, 1 pound per square inch = 6.9 kPa, 1 British thermal unit per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L.

matic fire-extinguishing system without a fire barrier, the incidental use area shall be separated from the remainder of the building by construction capable of resisting the passage of smoke. The partitions shall extend from the floor to the underside of the fire-resistance-rated floor/ceiling assembly or fire-resistance-rated roof/ceiling assembly above or to the underside of the floor or roof sheathing, or sub deck above. Doors shall be self- or automatic closing upon detection of smoke in accordance with Section 715.4.7.3. Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80.

508.2.3 Protection. Where an automatic fire-extinguishing system or an automatic sprinkler system is provided in accordance with Table 508.2, only the incidental use areas need be equipped with such a system.

508.3 Mixed occupancies. Each portion of a building shall be individually classified in accordance with Section 302.1.

Where a building contains more than one occupancy group, the building or portion thereof shall comply with Sections 508.3.1, 508.3.2, 508.3.3 or a combination of these sections.

Exceptions:

1. Occupancies separated in accordance with Section 509.
2. Where required by Table 415.3.2, areas of Group H-1, H-2 or H-3 occupancies shall be located in a separate and detached building or structure.

508.3.1 Accessory occupancies. Accessory occupancies are those occupancies subsidiary to the main occupancy of the building or portion thereof. Aggregate accessory occupancies shall not occupy more than 10 percent of the area of the story in which they are located and shall not exceed the tabular values in Table 503, without height and area increases in accordance with Sections 504 and 506 for such accessory occupancies.

Exceptions:

1. Accessory assembly areas having a floor area less than 750 square feet (69.7 m^2) are not considered separate occupancies.
2. Assembly areas that are accessory to Group E occupancies are not considered separate occupancies except when applying the assembly occupancy requirements of Chapter 11.
3. Accessory religious educational rooms and religious auditoriums with occupant loads of less than 100 are not considered separate occupancies.

508.3.1.1 Occupancy classification. Accessory occupancies shall be individually classified in accordance with Section 302.1. Code requirements shall apply to each portion of the building based on the occupancy classification of that accessory space, except that the most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the entire building or portion thereof.

508.3.1.2 Allowable area and height. The allowable area and height of the building shall be based on the allowable area and height for the main occupancy in accordance with Section 503.1. The height of any accessory occupancy shall not exceed the tabular values in Table 503, without height and area increases in accordance with Sections 504 and 506 for such accessory occupancies.

508.3.1.3 Separation. No separation is required between accessory occupancies or the main occupancy.

Exception: Group H-2, H-3, H-4 or H-5 occupancies shall be separated from all other occupancies in accordance with Section 508.3.3.

508.3.2 Nonseparated occupancies. Buildings or portions of buildings that comply with the provisions of this section shall qualify as nonseparated occupancies.

508.3.2.1 Occupancy classification. Nonseparated occupancies shall be individually classified in accordance with Section 302.1. Code requirements shall apply to each portion of the building based on the occupancy classification of that space except that the most restrictive applicable provisions of Section 403 and Chapter 9 shall apply to the entire building or portion thereof.

508.3.2.2 Allowable area and height. The allowable area and height of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1.

508.3.2.3 Separation. No separation is required between occupancies.

Exception: Group H-2, H-3, H-4 or H-5 occupancies shall be separated from all other occupancies in accordance with Section 508.3.3.

508.3.3 Separated occupancies. Buildings or portions of buildings that comply with the provisions of this section shall qualify as separated occupancies.

508.3.3.1 Occupancy classification. Separated occupancies shall be individually classified in accordance with Section 302.1. Each fire area shall comply with this code based on the occupancy classification of that portion of the building.

508.3.3.2 Allowable area. In each story, the building area shall be such that the sum of the ratios of the actual floor area of each occupancy divided by the allowable area of each occupancy shall not exceed one.

508.3.3.3 Allowable height. Each occupancy shall comply with the height limitations based on the type of construction of the building in accordance with Section 503.1. The height, in both feet and stories, of each fire area shall be measured from grade plane. This measurement shall include the height, in both feet and stories, of intervening fire areas.

Exception: Special provisions permitted by Section 509.

TABLE 508.3.3
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

OCCUPANCY	A[e], E, D		I		R[d]		F-2, F-3, S-2[c,d], U[d]		B[b], F-1, M[b], S-1		H-1		H-2		H-3, H-4, H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A[e], E[e], D	N	N	1	2	1	2	N	1	1	2	NP	NP	3	4	2	3[a]
I	—	—	N	N	1	NP	1	2	1	2	NP	NP	3	NP	2	NP
R[d]	—	—	—	—	N	N	1	2	1	2	NP	NP	3	NP	2	NP
F-2, F-3, S-2[c,d], U[d]	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3[a]
B[b], F-1, M[b], S-1	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2[a]
H-1	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP
H-3, H-4, H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

For SI: 1 square foot = 0.0929 m^2.

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

N = No separation requirement.

NP = Not permitted.

a. For Group H-5 occupancies, see Section 903.2.4.2.

b. Occupancy separation need not be provided for storage areas within Groups B and M if the:

1. Area is less than 10 percent of the floor area;
2. Area is equipped with an automatic fire-extinguishing system and is less than 3,000 square feet; or
3. Area is less than 1,000 square feet.

c. Areas used only for private or pleasure vehicles shall be allowed to reduce separation by 1 hour.

d. See Section 406.1.4.

e. Commercial kitchens need not be separated from the restaurant seating areas that they serve.

508.3.3.4 Separation. Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.3.3

508.3.3.4.1 Construction. Required separations shall be fire barriers constructed in accordance with Section 706 or horizontal assemblies constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies.

SECTION 509
SPECIAL PROVISIONS

509.1 General. The provisions in this section shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable heights and areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code.

509.2 Group S-2 enclosed or open parking garage with Group A, B, M, R or S above. A basement and/or the first story above grade plane of a building shall be considered as a separate and distinct building for the purpose of determining area limitations, continuity of fire walls, limitation of number of stories and type of construction when all of the following conditions are met:

1. The basement and/or the first story above grade plane is of Type IA construction and is separated from the building above with a horizontal assembly having a minimum 3-hour fire-resistance rating.
2. Shaft, stairway, ramp or escalator enclosures through the horizontal assembly shall have not less than a 2-hour fire-resistance rating with opening protectives in accordance with Table 715.4.

   Exception: Where the enclosure walls below the horizontal assembly have not less than a 3-hour fire-resistance rating with opening protectives in accordance with Table 715.4, the enclosure walls extending above the horizontal assembly shall be permitted to have a 1-hour fire-resistance rating, provided:

   1. The building above the horizontal assembly is not required to be of Type I construction;
   2. The enclosure connects less than four stories; and
   3. The enclosure opening protectives above the horizontal assembly have a minimum 1-hour fire protection rating.
3. The building above the horizontal assembly shall be permitted to have multiple Group A uses, each with an occupant load of less than 300, or Group B, M, R or S uses.
4. The building below the horizontal assembly is a Group S-2 enclosed or open parking garage, used for the parking and storage of private motor vehicles.

Exceptions:

1. Entry lobbies, mechanical rooms and similar uses incidental to the operation of the building shall be permitted.
2. Multiple Group A uses, each with an occupant load of less than 300, or Group B or M uses shall be permitted, in addition to those uses incidental to the operation of the building (including storage areas), provided that the entire structure below the horizontal assembly is protected throughout by an approved automatic sprinkler system.

5. The maximum building height in feet shall not exceed the limits set forth in Section 503 for the building having the smaller allowable height as measured from the grade plane.

509.3 Group S-2 enclosed parking garage with Group S-2 open parking garage above. A Group S-2 enclosed parking garage located in the basement or first story below a Group S-2 open parking garage shall be classified as a separate and distinct building for the purpose of determining the type of construction when the following conditions are met:

1. The allowable area of the structure shall be such that the sum of the ratios of the actual area divided by the allowable area for each separate occupancy shall not exceed 1.0.
2. The Group S-2 enclosed parking garage is of Type I or II construction and is at least equal to the fire-resistance requirements of the Group S-2 open parking garage.
3. The height and the number of the floors above the basement shall be limited as specified in Table 406.3.5.
4. The floor assembly separating the Group S-2 enclosed parking garage and Group S-2 open parking garage shall be protected as required for the floor assembly of the Group S-2 enclosed parking garage. Openings between the Group S-2 enclosed parking garage and Group S-2 open parking garage, except exit openings, shall not be required to be protected.
5. The Group S-2 enclosed parking garage is used exclusively for the parking or storage of private motor vehicles, but shall be permitted to contain an office, waiting room and toilet room having a total area of not more than 1,000 square feet (93 m^2), and mechanical equipment rooms incidental to the operation of the building.

509.4 Parking beneath Group R. Where a maximum one-story above grade plane Group S-2 parking garage, enclosed or open, or combination thereof, of Type I construction or open of Type IV construction, with grade entrance, is provided under a building of Group R, the number of stories to be used in determining the minimum type of construction shall be measured from the floor above such a parking area. The number of stories to be used in determining the height in stories in accordance with Section 903.6 shall include the parking garage as a story. The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a fire-resistance rating not less than the mixed occupancy separation required in Section 302.3.2.

509.5 Group R-2 buildings of Type IIIA construction. The height limitation for buildings of Type IIIA construction in Group R-2 shall be increased to six stories and 75 feet (22 860 mm) where the first-floor construction above the basement has a fire-resistance rating of not less than 3 hours and the floor area is subdivided by 2-hour fire-resistance-rated fire walls into areas of not more than 3,000 square feet (279 m^2).

509.6 Group R-2 buildings of Type IIA construction. The height limitation for buildings of Type IIA construction in Group R-2 shall be increased to nine stories and 100 feet (30 480 mm) where the building is separated by not less than 50 feet (15 240 mm) from any other building on the lot and from lot lines, the exits are segregated in an area enclosed by a 2-hour fire-resistance-rated fire wall and the first-floor construction has a fire-resistance rating of not less than $1^1/_2$ hours.

509.7 Open parking garage beneath Groups A, I, B, M and R. Open parking garages constructed under Groups A, I, B, M and R shall not exceed the height and area limitations permitted under Section 406.3. The height and area of the portion of the building above the open parking garage shall not exceed the limitations in Section 503 for the upper occupancy. The height, in both feet and stories, of the portion of the building above the open parking garage shall be measured from grade plane and shall include both the open parking garage and the portion of the building above the parking garage.

509.7.1 Fire separation. Fire barriers constructed in accordance with Section 706 or horizontal assemblies constructed in accordance with Section 711 between the parking occupancy and the upper occupancy shall correspond to the required fire-resistance rating prescribed in Table 508.3.3 for the uses involved. The type of construction shall apply to each occupancy individually, except that structural members, including main bracing within the open parking structure, which is necessary to support the upper occupancy, shall be protected with the more restrictive fire-resistance-rated assemblies of the groups involved as shown in Table 601. Means of egress for the upper occupancy shall conform to Chapter 10 and shall be separated from the parking occupancy by fire barriers having at least a 2-hour fire-resistance rating as required by Section 706 with self-closing doors complying with Section 715 or horizontal assemblies having at least a 2-hour fire-resistance rating as required by Section 711, with self-closing doors complying with Section 715. Means of egress from the open parking garage shall comply with Section 406.3.

509.8 Group B or M with Group S-2 open parking garage above. Group B or M uses located in the basement or first story below a Group S-2 open parking garage shall be classified as a separate and distinct building for the purpose of determining the type of construction when all of the following conditions are met:

1. The basement or first story shall be Type I or II construction, but not less than the type of construction required for the open parking garage above. The height and area of the basement or first story shall not exceed the limitations in Section 503 for the Group B or M uses.

2. The height and area of the open parking garage shall not exceed the limitations permitted under Section 406.3. The height, in both feet and stories, of the open parking garage shall be measured from grade plane and include both the open parking garage and the basement or first story.
3. Fire separation assemblies between the open parking garage and the basement or first story use group shall correspond to the required fire-resistance rating prescribed by Table 508.3.3
4. Exits serving the open parking garage shall discharge directly to a street or public way and shall be separated from the basement or first story use group by not less than 2-hour fire barriers constructed in accordance with Section 706 or 2-hour horizontal assemblies constructed in accordance with Section 711, or both, with opening protectives in accordance with Table 715.4.

CHAPTER 6
TYPES OF CONSTRUCTION

SECTION 601
GENERAL

601.1 Scope. The provisions of this chapter shall control the classification of buildings as to type of construction.

SECTION 602
CONSTRUCTION CLASSIFICATION

602.1 General. Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5. The building elements shall have a fire-resistance rating not less than that specified in Table 601 and exterior walls shall have a fire-resistance rating not less than that specified in Table 602.

602.1.1 Minimum requirements. A building or portion thereof shall not be required to conform to the details of a type of construction higher than that type, which meets the minimum requirements based on occupancy even though certain features of such a building actually conform to a higher type of construction.

602.2 Types I and II. Type I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 603 and elsewhere in this code.

602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.

602.4 Type IV. Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces. The details of Type IV construction shall comply with the provisions of this section. Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies with a 2-hour rating or less. Minimum solid sawn nominal dimensions are required for structures built using Type IV construction (HT). For glued-laminated members the equivalent net finished width and depths corresponding to the minimum nominal width and depths of solid sawn lumber are required as specified in Table 602.4.

602.4.1 Columns. Wood columns shall be sawn or glued laminated and shall not be less than 8 inches (203 mm), nominal, in any dimension where supporting floor loads and not less than 6 inches (152 mm) nominal in width and not less than 8 inches (203 mm) nominal in depth where supporting roof and ceiling loads only. Columns shall be continuous or superimposed and connected in an approved manner.

602.4.2 Floor framing. Wood beams and girders shall be of sawn or glued-laminated timber and shall be not less than 6 inches (152 mm) nominal in width and not less than 10 inches (254 mm) nominal in depth. Framed sawn or glued-laminated timber arches, which spring from the floor line and support floor loads, shall be not less than 8 inches (203 mm) nominal in any dimension. Framed timber trusses supporting floor loads shall have members of not less than 8 inches (203 mm) nominal in any dimension.

602.4.3 Roof framing. Wood-frame or glued-laminated arches for roof construction, which spring from the floor line or from grade and do not support floor loads, shall have members not less than 6 inches (152 mm) nominal in width and have less than 8 inches (203 mm) nominal in depth for the lower half of the height and not less than 6 inches (152 mm) nominal in depth for the upper half. Framed or glued-laminated arches for roof construction that spring from the top of walls or wall abutments, framed timber trusses and other roof framing, which do not support floor loads, shall have members not less than 4 inches (102 mm) nominal in width and not less than 6 inches (152 mm) nominal in depth. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches (76 mm) nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches (51 mm) nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches (76 mm) nominal in thickness. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches (76 mm) nominal in width.

602.4.4 Floors. Floors shall be without concealed spaces. Wood floors shall be of sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally, or 0.5-inch (12.7 mm) particleboard or planks not less than 4 inches (102 mm) nominal in width set on edge close together and well spiked and covered with 1-inch (25 mm) nominal dimension flooring or $^{15}/_{32}$-inch (12 mm) wood structural panel or 0.5-inch (12.7 mm) particleboard. The lumber shall be laid so that no continuous line of joints will occur except at points of support. Floors shall not extend closer than 0.5 inch (12.7 mm) to walls. Such 0.5-inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbeling of masonry walls under the floor shall be permitted to be used in place of molding.

602.4.5 Roofs. Roofs shall be without concealed spaces and wood roof decks shall be sawn or glued laminated, splined or tongue-and-groove plank, not less than 2 inches (51 mm) nominal in thickness, $1^{1}/_{8}$-inch-thick (32 mm) wood structural panel (exterior glue), or of planks not less than 3 inches

(76 mm) nominal in width, set on edge close together and laid as required for floors. Other types of decking shall be permitted to be used if providing equivalent fire resistance and structural properties.

602.4.6 Partitions. Partitions shall be of solid wood construction formed by not less than two layers of 1-inch (25 mm) matched boards or laminated construction 4 inches (102 mm) thick, or of 1-hour fire-resistance-rated construction.

602.4.7 Exterior structural members. Where a horizontal separation of 20 feet (6096 mm) or more is provided, wood columns and arches conforming to heavy timber sizes shall be permitted to be used externally.

602.5 Type V. Type V construction is that type of construction in which the structural elements, exterior walls and interior walls are of any materials permitted by this code.

SECTION 603
COMBUSTIBLE MATERIAL IN TYPE I AND II CONSTRUCTION

603.1 Allowable materials. Combustible materials shall be permitted in buildings of Type I or Type II construction in the following applications and in accordance with Sections 603.1.1 through 603.1.3:

1. Fire-retardant-treated wood shall be permitted in:
   - 1.1. Nonbearing partitions where the required fire-resistance rating is 2 hours or less.
   - 1.2. Nonbearing exterior walls where no fire rating is required.
   - 1.3. Roof construction, including girders, trusses, framing and decking.

     Exception: In buildings of Type I construction exceeding two stories in height, fire-retardant-treated wood is not permitted in roof construction when the vertical distance from the upper floor to the roof is less than 20 feet (6096 mm).
2. Thermal and acoustical insulation, other than foam plastics, having a flame spread index of not more than 25.

   Exceptions:

   1. Insulation placed between two layers of noncombustible materials without an intervening airspace shall be allowed to have a flame spread index of not more than 100.
   2. Insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a flame spread index of not more than 200.
3. Foam plastics in accordance with Chapter 26.
4. Roof coverings that have an A, B or C classification.
5. Interior floor finish and interior finish, trim and millwork such as doors, door frames, window sashes and frames.
6. Where not installed over 15 feet (4572 mm) above grade, show windows, nailing or furring strips and wooden bulkheads below show windows, including their frames, aprons and show cases.
7. Finished flooring applied directly to the floor slab or to wood sleepers that are fireblocked in accordance with Section 717.2.7.
8. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and that do not establish a corridor serving an occupant load of 30 or more shall be permitted to be constructed of fire-retardant-treated wood, 1-hour fire-resistance-rated construction or of wood panels or similar light construction up to 6 feet (1829 mm) in height.
9. Stages and platforms constructed in accordance with Sections 410.3 and 410.4, respectively.
10. Combustible exterior wall coverings, balconies and similar projections and bay or oriel windows in accordance with Chapter 14.
11. Blocking such as for handrails, millwork, cabinets and window and door frames.
12. Light-transmitting plastics as permitted by Chapter 26.
13. Mastics and caulking materials applied to provide flexible seals between components of exterior wall construction.
14. Exterior plastic veneer installed in accordance with Section 2605.2.
15. Nailing or furring strips as permitted by Section 803.4.
16. Heavy timber as permitted by Note d to Table 601 and Sections 602.4.7 and 1406.3.
17. Aggregates, component materials and admixtures as permitted by Section 703.2.2.
18. Sprayed fire-resistant materials and intumescent and mastic fire-resistant coatings, determined on the basis of fire-resistance tests in accordance with Section 703.2 and installed in accordance with Section 1704.10 and 1704.11, respectively.
19. Materials used to protect penetrations in fire-resistance-rated assemblies in accordance with Section 712.
20. Materials used to protect joints in fire-resistance-rated assemblies in accordance with Section 713.
21 Materials allowed in the concealed spaces of buildings of Type I and II construction in accordance with Section 717.5.
22. Materials exposed within plenums complying with Section 602 of the *Florida Building Code, Mechanical.*

603.1.1 Ducts. The use of nonmetallic ducts shall be permitted when installed in accordance with the limitations of the *Florida Building Code, Mechanical.*

603.1.2 Piping. The use of combustible piping materials shall be permitted when installed in accordance with the limitations of the *Florida Building Code, Mechanical* and the *Florida Building Code, Plumbing*.

603.1.3 Electrical. The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted when installed in accordance with the limitations of Chapter 27 of the *Florida Building Code, Building*.

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Structural frame[a]	3[b,h]	2[b]	1	0	1	0	HT	1	0
Bearing walls									
Exterior[g]	4	3	1	0	2	2	2	1	0
Interior	4[b]	3[b]	1	0	1	0	2[b]/HT	1	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[f]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction Including supporting beams and joists	3[h]	2	1[e]	0[e,i]	1[e]	0[e,i]	HT	1	0[i]
Roof construction Including supporting beams and joists	$1\frac{1}{2}$[c,h]	1[c,d]	1[c,d]	0[d]	1[d]	0[d]	HT	1[c,d]	0

For SI: 1 foot = 304.8 mm.

a. The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof panels which have no connection to the columns shall be considered secondary members and not a part of the structural frame.

b. Fire-resistance ratings of structural frame and bearing walls are permitted to be reduced by 1 hour where supporting one floor or one roof only.

c. Except in Group F-1, H, I, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.

d. In all occupancies, heavy timber shall be allowed where a 1-hour or less fire-resistance rating is required.

e. Group B and M occupancies of Type II or III construction five or more stories in height shall be required to have a minimum 2-hour fire-resistance rating for the floor construction located over the basement.

f. Not less than the fire-resistance rating required by other sections of this code.

g. Not less than the fire-resistance rating based on fire separation distance (see Table 602).

h. For Group A, B, E, F and R occupancies and parking garages, the required fire-resistance ratings for the structural frame, floor and roof construction, including supporting beams and joists, shall be permitted to be reduced by 1 hour where the building is protected throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, but the fire-resistance rating shall not be less than 1 hour.

i. For unsprinklered Group E occupancies of Type, IIB, IIIB, IV or VB construction, the floor construction located immediately above useable space in basements shall have a fire-resistance rating of not less than 1 hour.

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, e]

FIRE SEPARATION DISTANCE = x (feet)	TYPE OF CONSTRUCTION	GROUP H	GROUP F-1, M, S-1	GROUP A, B, E, F-2, I, R, S-2, U[b]
$x < 5^c$	I-A, I-B, III-A, III-B, IV Others	3 3	3 2	3 1
$5 \leq x < 10$	I-A, I-B, III-A, III-B, IV Others	3 2	2 1	2 1
$10 \leq x < 20$	I-A, I-B, III-A, III-B, IV IIB, VB Others	2 1 1	2 0 1	2 0 1
$20 \leq x < 30$	I-A, I-B, III-A, III-B, IV Others	1 1	1 0	1[d] 0[d]
$x \geq 30$	All	0	0	0

For SI: 1 foot = 304.8 mm.
a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
b. For special requirements for Group U occupancies see Section 406.1.2
c. See Section 705.1.1 for party walls.
d. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
e. The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.

TABLE 602.4
WOOD MEMBER SIZE

MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE	
Width, inch	Depth, inch	Width, inch	Depth, inch
8	8	$6\ 3/4$	$8\ 1/4$
6	10	5	$10\ 1/2$
6	8	5	$8\ 1/4$
6	6	5	6
4	6	3	$6\ 7/8$

For SI: 1 inch = 25.4 mm.

CHAPTER 7
FIRE-RESISTANCE-RATED CONSTRUCTION

SECTION 701
GENERAL

701.1 Scope. The provisions of this chapter shall govern the materials and assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.

SECTION 702
DEFINITIONS

702.1 Definitions. The following words and terms shall, for the purposes of this chapter, and as used elsewhere in this code, have the meanings shown herein.

ANNULAR SPACE. The opening around the penetrating item.

CEILING RADIATION DAMPER. A listed device installed in a ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit automatically the radiative heat transfer through an air inlet/outlet opening.

COMBINATION FIRE/SMOKE DAMPER. A listed device installed in ducts and air transfer openings designed to close automatically upon the detection of heat and resist the passage of flame and smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

DAMPER. See "Ceiling radiation damper," "Combination fire/smoke damper," "Fire damper" and "Smoke damper."

DRAFTSTOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies and attics.

F RATING. The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814.

FIRE AREA. The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or fire-resistance-rated horizontal assemblies of a building.

FIRE BARRIER. A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

FIRE DAMPER. A listed device installed in ducts and air transfer openings designed to close automatically upon detection of heat and resist the passage of flame. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic fire damper is tested and rated for closure under elevated temperature airflow.

FIRE DOOR. The door component of a fire door assembly.

FIRE DOOR ASSEMBLY. Any combination of a fire door, frame, hardware, and other accessories that together provide a specific degree of fire protection to the opening.

FIRE PARTITION. A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.

FIRE PROTECTION RATING. The period of time that an opening protective assembly will maintain the ability to confine a fire as determined by tests prescribed in Section 715. Ratings are stated in hours or minutes.

FIRE RESISTANCE. That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

FIRE-RESISTANCE RATING. The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.

FIRE-RESISTANT JOINT SYSTEM. An assemblage of specific materials or products that are designed, tested, and fire-resistance rated in accordance with either ASTM E 1966 or UL 2079 to resist for a prescribed period of time the passage of fire through joints made in or between fire-resistance-rated assemblies.

FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. The closest interior lot line;
2. To the centerline of a street, an alley or public way; or
3. To an imaginary line between two buildings on the property.

The distance shall be measured at right angles from the face of the wall.

FIRE WALL. A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

FIRE WINDOW ASSEMBLY. A window constructed and glazed to give protection against the passage of fire.

FIREBLOCKING. Building materials installed to resist the free passage of flame to other areas of the building through concealed spaces.

FLOOR FIRE DOOR ASSEMBLY. A combination of a fire door, a frame, hardware and other accessories installed in a horizontal plane, which together provide a specific degree of fire protection to a through-opening in a fire-resistance-rated floor (see Section 711.8).

HORIZONTAL ASSEMBLY. A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.

JOINT. The linear opening in or between adjacent fire-resistance-rated assemblies that is designed to allow independent movement of the building in any plane caused by thermal, wind or any other loading.

MEMBRANE PENETRATION. An opening made through one side (wall, floor or ceiling membrane) of an assembly.

MEMBRANE-PENETRATION FIRESTOP. A material, device or construction installed to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane in order to accommodate cables, cable trays, conduit, tubing, pipes or similar items.

MINERAL FIBER. Insulation composed principally of fibers manufactured from rock, slag or glass, with or without binders.

MINERAL WOOL. Synthetic vitreous fiber insulation made by melting predominately igneous rock or furnace slag, and other inorganic materials, and then physically forming the melt into fibers.

PENETRATION FIRESTOP. A through-penetration firestop or a membrane-penetration firestop.

SELF-CLOSING. As applied to a fire door or other opening, means equipped with an approved device that will ensure closing after having been opened.

SHAFT. An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof.

SHAFT ENCLOSURE. The walls or construction forming the boundaries of a shaft.

SMOKE BARRIER. A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

SMOKE COMPARTMENT. A space within a building enclosed by smoke barriers on all sides, including the top and bottom.

SMOKE DAMPER. A listed device installed in ducts and air transfer openings designed to resist the passage of smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

SPLICE. The result of a factory and/or field method of joining or connecting two or more lengths of a fire-resistant joint system into a continuous entity.

T RATING. The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the nonfire side when tested in accordance with ASTM E 814.

THROUGH PENETRATION. An opening that passes through an entire assembly.

THROUGH-PENETRATION FIRESTOP SYSTEM. An assemblage of specific materials or products that are designed, tested and fire-resistance rated to resist for a prescribed period of time the spread of fire through penetrations. The F and T rating criteria for penetration firestop systems shall be in accordance with ASTM E 814. See definitions of "F rating" and "T rating."

SECTION 703
FIRE-RESISTANCE RATINGS AND FIRE TESTS

703.1 Scope. Materials prescribed herein for fire resistance shall conform to the requirements of this chapter.

703.2 Fire-resistance ratings. The fire-resistance rating of building elements shall be determined in accordance with the test procedures set forth in ASTM E 119 or in accordance with Section 703.3. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the assembly, sufficient data shall be made available to the building official to show that the required fire-resistance rating is not reduced. Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements shall not reduce the required fire-resistance rating.

Exception: In determining the fire-resistance rating of exterior bearing walls, compliance with the ASTM E 119 criteria for unexposed surface temperature rise and ignition of cotton waste due to passage of flame or gases is required only for a period of time corresponding to the required fire-resistance rating of an exterior nonbearing wall with the same fire separation distance, and in a building of the same group. When the fire-resistance rating determined in accordance with this exception exceeds the fire-resistance rating determined in accordance with ASTM E 119, the fire exposure time period, water pressure, and application duration criteria for the hose stream test of ASTM E 119 shall be based upon the fire-resistance rating determined in accordance with this exception.

703.2.1 Nonsymmetrical wall construction. Interior walls and partitions of nonsymmetrical construction shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests conducted in compliance with ASTM E 119. When evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side (see Section 704.5 for exterior walls).

703.2.2 Combustible components. Combustible aggregates are permitted in gypsum and portland cement concrete mixtures approved for fire-resistance-rated construction. Any approved component material or admixture is permitted in assemblies if the resulting tested assembly meets the fire-resistance test requirements of this code.

703.2.3 Restrained classification. Fire-resistance-rated assemblies tested under ASTM E 119 shall not be considered to be restrained unless evidence satisfactory to the building official is furnished by the registered design professional showing that the construction qualifies for a restrained classification in accordance with ASTM E 119. Restrained construction shall be identified on the plans.

703.3 Alternative methods for determining fire resistance. The application of any of the alternative methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E 119. The required fire resistance of a building element shall be permitted to be established by any of the following methods or procedures:

1. Fire-resistance designs documented in approved sources.
2. Prescriptive designs of fire-resistance-rated building elements as prescribed in Section 720.
3. Calculations in accordance with Section 721.
4. Engineering analysis based on a comparison of building element designs having fire-resistance ratings as determined by the test procedures set forth in ASTM E 119.
5. Alternative protection methods as allowed by Section 104.11.

703.4 Noncombustibility tests. The tests indicated in Sections 703.4.1 and 703.4.2 shall serve as criteria for acceptance of building materials as set forth in Sections 602.2, 602.3 and 602.4 in Type I, II, III and IV construction. The term "noncombustible" does not apply to the flame spread characteristics of interior finish or trim materials. A material shall not be classified as a noncombustible building construction material if it is subject to an increase in combustibility or flame spread beyond the limitations herein established through the effects of age, moisture or other atmospheric conditions.

703.4.1 Elementary materials. Materials required to be noncombustible shall be tested in accordance with ASTM E 136.

703.4.2 Composite materials. Materials having a structural base of noncombustible material as determined in accordance with Section 703.4.1 with a surfacing not more than 0.125 inch (3.18 mm) thick that has a flame spread index not greater than 50 when tested in accordance with ASTM E 84 shall be acceptable as noncombustible materials.

SECTION 704
EXTERIOR WALLS

704.1 General. Exterior walls shall comply with this section.

704.2 Projections. Cornices, eave overhangs, exterior balconies and similar projections extending beyond the floor area shall conform to the requirements of this section and Section 1406. Exterior egress balconies and exterior exit stairways shall also comply with Sections 1014.5 and 1023.1, respectively. Projections shall not extend beyond the distance determined by the following two methods, whichever results in the lesser projection:

1. A point one-third the distance to the lot line from an assumed vertical plane located where protected openings are required in accordance with Section 704.8.
2. More than 12 inches (305 mm) into areas where openings are prohibited.

704.2.1 Type I and II construction. Projections from walls of Type I or II construction shall be of noncombustible materials or combustible materials as allowed by Sections 1406.3 and 1406.4.

704.2.2 Type III, IV or V construction. Projections from walls of Type III, IV or V construction shall be of any approved material.

704.2.3 Combustible projections. Combustible projections located where openings are not permitted or where protection of openings is required shall be of at least 1-hour fire-resistance-rated construction, Type IV construction, fire-retardant-treated wood or as required by Section 1406.3.

Exception: Type V construction shall be allowed for R-3 occupancies.

704.3 Buildings on the same lot. For the purposes of determining the required wall and opening protection and roof-covering requirements, buildings on the same lot shall be assumed to have an imaginary line between them.

Where a new building is to be erected on the same lot as an existing building, the location of the assumed imaginary line with relation to the existing building shall be such that the exterior wall and opening protection of the existing building meet the criteria as set forth in Sections 704.5 and 704.8.

Exception: Two or more buildings on the same lot shall either be regulated as separate buildings or shall be considered as portions of one building if the aggregate area of such buildings is within the limits specified in Chapter 5 for a single building. Where the buildings contain different occupancy groups or are of different types of construction, the area shall be that allowed for the most restrictive occupancy or construction.

704.4 Materials. Exterior walls shall be of materials permitted by the building type of construction.

704.5 Fire-resistance ratings. Exterior walls shall be fire-resistance rated in accordance with Tables 601 and 602. The fire-resistance rating of exterior walls with a fire separation distance of greater than 5 feet (1524 mm) shall be rated for exposure to fire from the inside. The fire-resistance rating of exterior walls with a fire separation distance of 5 feet (1524 mm) or less shall be rated for exposure to fire from both sides.

704.6 Structural stability. The wall shall extend to the height required by Section 704.11 and shall have sufficient structural stability such that it will remain in place for the duration of time indicated by the required fire-resistance rating.

704.7 Unexposed surface temperature. Where protected openings are not limited by Section 704.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E 119 shall not apply. Where protected openings are limited by Section 704.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E 119 shall not apply provided that a correction is made for radiation from the unexposed exterior wall surface in accordance with the following formula:

$$A_e = A + (A_f \times F_{eo}) \qquad \textbf{(Equation 7-1)}$$

where:

A_e = Equivalent area of protected openings.

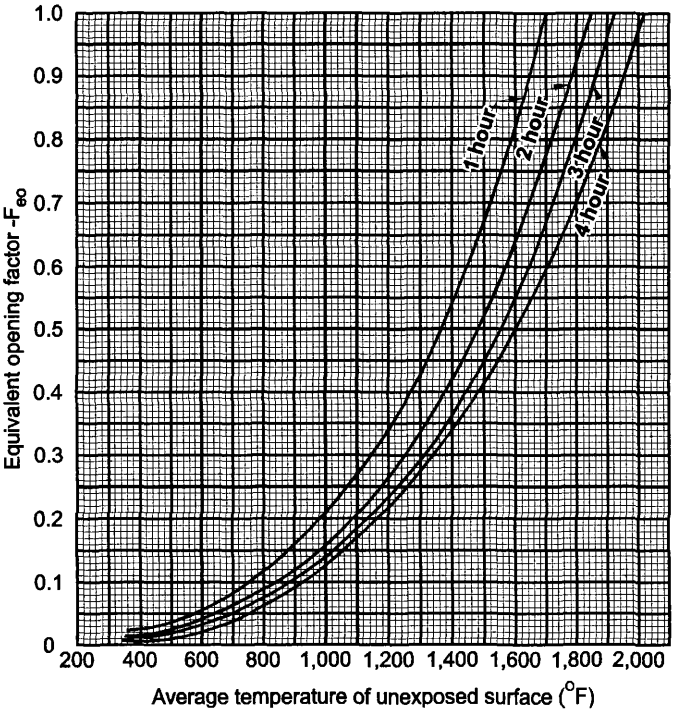
A = Actual area of protected openings.

A_f = Area of exterior wall surface in the story under consideration exclusive of openings, on which the temperature limitations of ASTM E 119 for walls are exceeded.

F_{eo} = An "equivalent opening factor" derived from Figure 704.7 based on the average temperature of the unexposed wall surface and the fire-resistance rating of the wall.

704.8 Allowable area of openings. The maximum area of unprotected or protected openings permitted in an exterior wall in any story shall not exceed the values set forth in Table 704.8. Where both unprotected and protected openings are located in the exterior wall in any story, the total area of the openings shall comply with the following formula:

$$\frac{A}{a} + \frac{A_u}{a_u} \leq 1.0 \qquad \textbf{(Equation 7-2)}$$



For SI: °C = [(°F) - 32] / 1.8.

FIGURE 704.7
EQUIVALENT OPENING FACTOR

TABLE 704.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS[a]

CLASSIFICATION OF OPENING	FIRE SEPARATION DISTANCE (feet)							
	0 to 3[f,j]	Greater than 3 to 5[c,g]	Greater than 5 to 10[c,e,g,h]	Greater than 10 to 15[d,e,g]	Greater than 15 to 20[d,g]	Greater than 20 to 25[d,g]	Greater than 25 to 30[d,g]	Greater than 30
Unprotected	Not Permitted	Not Permitted[c]	10%[i]	15%[i]	25%[i]	45%[i]	70%[i]	No Limit
Protected	Not Permitted	15%	25%	45%	75%	No Limit	No Limit	No Limit

For SI: 1 foot = 304.8 mm.

a. Values given are percentage of the area of the exterior wall.

b. Deleted.

c. For occupancies in Group R-3, the maximum percentage of unprotected and protected exterior wall openings shall be 25 percent.

d. The area of openings in an open parking structure with a fire separation distance of greater than 10 feet shall not be limited.

e. For occupancies in Group H-2 or H-3, unprotected openings shall not be permitted for openings with a fire separation distance of 15 feet or less.

f. For requirements for fire walls for buildings with differing roof heights, see Section 705.6.1.

g. The area of unprotected and protected openings is not limited for occupancies in Group R-3, with a fire separation distance greater than 5 feet.

h. For special requirements for Group U occupancies, see Section 406.1.2.

i. Buildings whose exterior bearing wall, exterior nonbearing wall and exterior structural frame are not required to be fire-resistance rated by Table 601 or 602 shall be permitted to have unlimited unprotected openings.

j. Includes accessory buildings to Group R-3.

where:

A = Actual area of protected openings, or the equivalent area of protected openings, A_e (see Section 704.7).

a = Allowable area of protected openings.

A_u = Actual area of unprotected openings.

a_u = Allowable area of unprotected openings.

704.8.1 Automatic sprinkler system. In buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum allowable area of unprotected openings in occupancies other than Groups H-1, H-2 and H-3 shall be the same as the tabulated limitations for protected openings.

704.8.2 First story. In occupancies other than Group H, unlimited unprotected openings are permitted in the first story of exterior walls facing a street that have a fire separation distance of greater than 15 feet (4572 mm) or facing an unoccupied space. The unoccupied space shall be on the same lot or dedicated for public use, shall not be less than 30 feet (9144 mm) in width and shall have access from a street by a posted fire lane in accordance with the *Florida Fire Prevention Code*.

704.9 Vertical separation of openings. Openings in exterior walls in adjacent stories shall be separated vertically to protect against fire spread on the exterior of the buildings where the openings are within 5 feet (1524 mm) of each other horizontally and the opening in the lower story is not a protected opening with a fire protection rating of not less than $^3/_4$ hour. Such openings shall be separated vertically at least 3 feet (914 mm) by spandrel girders, exterior walls or other similar assemblies that have a fire-resistance rating of at least 1 hour or by flame barriers that extend horizontally at least 30 inches (762 mm) beyond the exterior wall. Flame barriers shall also have a fire-resistance rating of at least 1 hour. The unexposed surface temperature limitations specified in ASTM E 119 shall not apply to the flame barriers or vertical separation unless otherwise required by the provisions of this code.

Exceptions:

1. This section shall not apply to buildings that are three stories or less in height.
2. This section shall not apply to buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Open parking garages.

704.10 Vertical exposure. For buildings on the same lot, opening protectives having a fire-protection rating of not less than $^3/_4$ hour shall be provided in every opening that is less than 15 feet (4572 mm) vertically above the roof of an adjoining building or adjacent structure that is within a horizontal fire separation distance of 15 feet (4572 mm) of the wall in which the opening is located.

Exception: Opening protectives are not required where the roof construction has a fire-resistance rating of not less than 1 hour for a minimum distance of 10 feet (3048 mm) from the adjoining building, and the entire length and span of the supporting elements for the fire-resistance-rated roof assembly has a fire-resistance rating of not less than 1 hour.

704.11 Parapets. Parapets shall be provided on exterior walls of buildings.

Exceptions: A parapet need not be provided on an exterior wall where any of the following conditions exist:

1. The wall is not required to be fire-resistance rated in accordance with Table 602 because of fire separation distance.
2. The building has an area of not more than 1,000 square feet (93 m^2) on any floor.
3. Walls that terminate at roofs of not less than 2-hour fire-resistance-rated construction or where the roof, including the deck or slab and supporting construction, is constructed entirely of noncombustible materials.
4. One-hour fire-resistance-rated exterior walls that terminate at the underside of the roof sheathing, deck or slab, provided:
   - 4.1. Where the roof/ceiling framing elements are parallel to the walls, such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction for a width of 4 feet (1220 mm) for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.
   - 4.2. Where roof/ceiling framing elements are not parallel to the wall, the entire span of such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction.
   - 4.3. Openings in the roof shall not be located within 5 feet (1524 mm) of the 1-hour fire-resistance-rated exterior wall for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.
   - 4.4. The entire building shall be provided with not less than a Class B roof covering.
5. In Groups R-2 and R-3 where the entire building is provided with a Class C roof covering, the exterior wall shall be permitted to terminate at the underside of the roof sheathing or deck in Type III, IV and V construction, provided:
   - 5.1. The roof sheathing or deck is constructed of approved noncombustible materials or of fire-retardant-treated wood for a distance of 4 feet (1220 mm); or
   - 5.2. The roof is protected with 0.625-inch (16 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof

framing members for a minimum distance of 4 feet (1220 mm).

6. Where the wall is permitted to have at least 25 percent of the exterior wall areas containing unprotected openings based on fire separation distance as determined in accordance with Section 704.8.

704.11.1 Parapet construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall, and on any side adjacent to a roof surface, shall have noncombustible faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials. The height of the parapet shall not be less than 30 inches (762 mm) above the point where the roof surface and the wall intersect. Where the roof slopes toward a parapet at a slope greater than two units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a fire separation distance where protection of wall openings is required, but in no case shall the height be less than 30 inches (762 mm).

704.12 Opening protection. Windows in exterior walls required to have protected openings in accordance with other sections of this code or determined to be protected in accordance with Section 704.3 or 704.8 shall comply with Section 715.5. Other openings required to be protected with fire door or shutter assemblies in accordance with other sections of this code or determined to be protected in accordance with Section 704.3 or 704.8 shall comply with Section 715.4.

Exception: Opening protectives are not required where the building is protected throughout by an automatic sprinkler system and the exterior openings are protected by an approved water curtain using automatic sprinklers approved for that use. The sprinklers and the water curtain shall be installed in accordance with Section 903.3.1.1 and shall have an automatic water supply and fire department connection.

704.12.1 Unprotected openings. Where protected openings are not required by Section 704, windows and doors shall be constructed of any approved materials. Glazing shall conform to the requirements of Chapters 24 and 26.

704.13 Joints. Joints made in or between exterior walls required by this section to have a fire-resistance rating shall comply with Section 713.

Exception: Joints in exterior walls that are permitted to have unprotected openings.

704.13.1 Voids. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 713.4.

704.14 Ducts and air transfer openings. Penetrations by air ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings shall comply with Section 716.

Exception: Foundation vents installed in accordance with this code are permitted.

SECTION 705
FIRE WALLS

705.1 General. Each portion of a building separated by one or more fire walls that comply with the provisions of this section shall be considered a separate building. For the purposes of determining height and area in accordance with Table 503, fire walls dividing buildings into separate buildings shall provide a 4-hour fire-resistance rating. The extent and location of such fire walls shall provide a complete separation. Where a fire wall also separates occupancies that are required to be separated by a fire barrier wall, the most restrictive requirements of each separation shall apply.

705.1.1 Party walls. Any wall located on a lot line between adjacent buildings, which is used or adapted for joint service between the two buildings, shall be constructed as a fire wall and shall provide a 4-hour fire-resistance rating in accordance with Section 705, without openings and shall create separate buildings.

705.2 Structural stability. Fire walls shall have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall for the duration of time indicated by the required fire-resistance rating.

705.3 Materials. Fire walls shall be constructed of any approved noncombustible materials.

705.4 Fire-resistance rating. Fire walls shall have a fire-resistance rating of not less than that required by Table 705.4.

TABLE 705.4
FIRE WALL FIRE-RESISTANCE RATINGS[c]

GROUP	FIRE-RESISTANCE RATING (hours)
A, B, D, E, H-4, I, R-1, R-2, U	3[a]
F-1, H-3[b], H-5, M, S-1	3
H-1, H-2	4[b]
F-2, S-2, R-3, R-4	2

a. Walls shall be not less than 2-hour fire-resistance rated where separating buildings of Type II or V construction.
b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.4 and 415.5.
c. For the purposes of determining height and area in accordance with Table 503, fire walls dividing buildings into separate buildings shall provide a 4-hour fire-resistance rating.

705.4.1 Townhouse fire separation.

705.4.1.1 Each townhouse shall be considered a separate building and shall be separated from adjoining townhouses by a party wall complying with Section 503.2 or by the use of separate exterior walls meeting the requirements of Tables 601 and 602 for zero clearance from property lines as required for the type of construction. Separate exterior walls shall include one of the following:

1. A parapet not less than 18 inches (457 mm) above the roof line.
2. Roof sheathing of noncombustible material or fire retardant-treated wood, for not less than a 4 foot (1219 mm) width on each side of the exterior dividing wall.

3. One layer of $^5/_8$-inch (15.9 mm) Type X gypsum board attached to the underside of roof decking, for not less than a 4 foot (1219 mm) width on each side of the exterior dividing wall.

705.4.1.2 When not more than three stories in height, townhouses may be separated by a single wall meeting the following requirements:

1. Such wall shall provide not less than a 2-hour fire-resistance rating. Plumbing, piping, ducts, electrical or other building services shall not be installed within or through the 2-hour wall unless such materials and methods of penetration have been tested in accordance with Section 703.
2. Such wall shall be continuous from the foundation to the underside of the roof sheathing or shall have a parapet extending not less than 18 inches (457 mm) and no less than a 4-foot (1219 mm) width on each side of the wall shall be of noncombustible material, or fire-retardant-treated wood, or one layer of $^5/_8$-inch (15.9 mm) Type X gypsum wallboard attached to the underside of the roof decking.
3. Each dwelling unit sharing such wall shall be designed and constructed to maintain its structural integrity independent of the unit on the opposite side of the wall.

   Exception: Said wall may be penetrated by roof and floor structural members provided that the fire-resistance rating and the structural integrity of the wall are maintained.

705.5 Horizontal continuity. Fire walls shall be continuous from exterior wall to exterior wall and shall extend at least 18 inches (457 mm) beyond the exterior surface of exterior walls.

Exceptions:

1. Fire walls shall be permitted to terminate at the interior surface of combustible exterior sheathing or siding provided the exterior wall has a fire-resistance rating of at least 1 hour for a horizontal distance of at least 4 feet (1220 mm) on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $^3/_4$ hour.
2. Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing, exterior siding or other noncombustible exterior finishes provided the sheathing, siding, or other exterior noncombustible finish extends a horizontal distance of at least 4 feet (1220 mm) on both sides of the fire wall.
3. Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing where the building on each side of the fire wall is protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

705.5.1 Exterior walls. Where the fire wall intersects the exterior walls, the fire-resistance rating for the exterior walls on both sides of the fire wall shall have a 1-hour fire-resistance rating with $^3/_4$-hour opening protection where opening protection is required. The fire-resistance rating of the exterior wall shall extend a minimum of 4 feet (1220 mm) on each side of the intersection of the fire wall to exterior wall. Exterior wall intersections at fire walls that form an angle equal to or greater than 180 degrees (3.14 rad) do not need exterior wall protection.

705.5.2 Horizontal projecting elements. Fire walls shall extend to the outer edge of horizontal projecting elements such as balconies, roof overhangs, canopies, marquees and similar projections that are within 4 feet (1220 mm) of the fire wall.

Exceptions:

1. Horizontal projecting elements without concealed spaces, provided the exterior wall behind and below the projecting element has not less than 1-hour fire-resistance-rated construction for a distance not less than the depth of the projecting element on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $^3/_4$ hour.
2. Noncombustible horizontal projecting elements with concealed spaces, provided a minimum 1-hour fire-resistance-rated wall extends through the concealed space. The projecting element shall be separated from the building by a minimum of 1-hour fire-resistance-rated construction for a distance on each side of the fire wall equal to the depth of the projecting element. The wall is not required to extend under the projecting element where the building exterior wall is not less than 1-hour fire-resistance rated for a distance on each side of the fire wall equal to the depth of the projecting element. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $^3/_4$ hour.
3. For combustible horizontal projecting elements with concealed spaces, the fire wall need only extend through the concealed space to the outer edges of the projecting elements. The exterior wall behind and below the projecting element shall be of not less than 1-hour fire-resistance-rated construction for a distance not less than the depth of the projecting elements on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire-protection rating of not less than $^3/_4$ hour.

705.6 Vertical continuity. Fire walls shall extend from the foundation to a termination point at least 30 inches (762 mm) above both adjacent roofs.

Exceptions:

1. Stepped buildings in accordance with Section 705.6.1.
2. Two-hour fire-resistance-rated walls shall be permitted to terminate at the underside of the roof sheathing, deck or slab provided:
   2.1. The lower roof assembly within 4 feet (1220 mm) of the wall has not less than a 1-hour fire-resistance rating and the entire length and span of supporting elements for the rated roof assembly has a fire-resistance rating of not less than 1 hour.
   2.2. Openings in the roof shall not be located within 4 feet (1220 mm) of the fire wall.
   2.3. Each building shall be provided with not less than a Class B roof covering.
3. Walls shall be permitted to terminate at the underside of noncombustible roof sheathing, deck, or slabs where both buildings are provided with not less than a Class B roof covering. Openings in the roof shall not be located within 4 feet (1220 mm) of the fire wall.
4. In buildings of Type III, IV and V construction, walls shall be permitted to terminate at the underside of combustible roof sheathing or decks provided:
   4.1. There are no openings in the roof within 4 feet (1220 mm) of the fire wall,
   4.2. The roof is covered with a minimum Class B roof covering, and
   4.3. The roof sheathing or deck is constructed of fire-retardant-treated wood for a distance of 4 feet (1220 mm) on both sides of the wall or the roof is protected with $^5/_8$ inch (15.9 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of 2-inch (51 mm) nominal ledgers attached to the sides of the roof framing members for a minimum distance of 4 feet (1220 mm) on both sides of the fire wall.
5. Buildings located above a parking garage designed in accordance with Section 509.2 shall be permitted to have the fire walls for the buildings located above the parking garage extend from the horizontal separation between the parking garage and the buildings.

705.6.1 Stepped buildings. Where a fire wall serves as an exterior wall for a building and separates buildings having different roof levels, such wall shall terminate at a point not less than 30 inches (762 mm) above the lower roof level, provided the exterior wall for a height of 15 feet (4572 mm) above the lower roof is not less than 1-hour fire-resistance-rated construction from both sides with openings protected by fire assemblies having a fire protection rating of not less than $^3/_4$ hour.

Exception: Where the fire wall terminates at the underside of the roof sheathing, deck or slab of the lower roof, provided:

1. The lower roof assembly within 10 feet (3048 mm) of the wall has not less than a 1-hour fire-resistance rating and the entire length and span of supporting elements for the rated roof assembly has a fire-resistance rating of not less than 1 hour.
2. Openings in the lower roof shall not be located within 10 feet (3048 mm) of the fire wall.

705.7 Combustible framing in fire walls. Adjacent combustible members entering into a concrete or masonry fire wall from opposite sides shall not have less than a 4-inch (102 mm) distance between embedded ends. Where combustible members frame into hollow walls or walls of hollow units, hollow spaces shall be solidly filled for the full thickness of the wall and for a distance not less than 4 inches (102 mm) above, below and between the structural members, with noncombustible materials approved for fireblocking.

705.8 Openings. Each opening through a fire wall shall be protected in accordance with Section 715.4 and shall not exceed 120 square feet (11 m^2). The aggregate width of openings at any floor level shall not exceed 25 percent of the length of the wall.

Exceptions:

1. Openings are not permitted in party walls constructed in accordance with Section 705.1.1.
2. Openings shall not be limited to 120 square feet (11 m^2) where both buildings are equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

705.9 Penetrations. Penetrations of fire walls shall comply with Section 712.

705.10 Joints. Joints made in or between fire walls shall comply with Section 713.

705.11 Ducts and air transfer openings. Ducts and air transfer openings shall not penetrate fire walls.

Exception: Penetrations by ducts and air transfer openings of fire walls that are not on a lot line shall be allowed provided the penetrations comply with Sections 712 and 716. The size and aggregate width of all openings shall not exceed the limitations of Section 705.8.

SECTION 706
FIRE BARRIERS

706.1 General. Fire barriers installed as required elsewhere in this code or the *Florida Fire Prevention Code* shall comply with this section.

706.2 Materials. Fire barriers shall be of materials permitted by the building type of construction.

706.2.1 Fire-resistance-rated glazing. Fire-resistance-rated glazing, when tested in accordance with ASTM E 119 and complying with the requirements of Section 706, shall be permitted. Fire-resistance-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and the identifier "W-XXX," where the "XXX" is the fire-resistance rating in minutes. Such label or identification shall be issued by an approved agency and shall be permanently affixed to the glazing.

706.3 Fire-resistance rating. The fire-resistance rating of fire barriers shall comply with this section.

706.3.1 Shaft enclosures. The fire-resistance rating of the fire barrier separating building areas from a shaft shall comply with Section 707.4.

706.3.2 Exit enclosures. The fire-resistance rating of the fire barrier separating building areas from an exit shall comply with Section 1020.1.

706.3.3 Exit passageway. The fire-resistance rating of the separation between building areas and an exit passageway shall comply with Section 1021.1.

706.3.4 Horizontal exit. The fire-resistance rating of the separation between building areas connected by a horizontal exit shall comply with Section 1022.1.

706.3.5 Atriums. The fire-resistance rating of the fire barrier separating atriums shall comply with Section 404.5.

706.3.6 Incidental use areas. The fire barrier separating incidental use areas shall have a fire-resistance rating of not less than that indicated in Table 508.2.

706.3.7 Control areas. Fire barriers separating control areas shall have a fire-resistance rating of not less than that required in Section 414.2.4.

706.3.8 Separation of mixed occupancies. Where the provisions of Section 508.3.3 are applicable, the fire barrier separating mixed occupancies shall have a fire-resistance rating of not less than that indicated in Section 508.3.3 based on the occupancies being separated.

706.3.9 Single-occupancy fire areas. The fire barrier or horizontal assembly, or both, separating a single occupancy into different fire areas shall have a fire-resistance rating of not less than that indicated in Table 706.3.9.

TABLE 706.3.9
FIRE-RESISTANCE RATING REQUIREMENTS FOR FIRE BARRIER ASSEMBLIES BETWEEN FIRE AREAS

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, D, E, F-2, F-3, H-4, H-5, I, M, R, S-2	2
U	1

706.4 Exterior walls. Where exterior walls serve as a part of a required fire-resistance-rated shaft or exit enclosure, such walls shall comply with the requirements of Section 704 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

Exception: Exterior walls required to be fire-resistance rated in accordance with Section 1023.6.

706.5 Continuity. Fire barriers shall extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above and shall be securely attached thereto. Such fire barriers shall be continuous through concealed spaces, such as the space above a suspended ceiling. The supporting construction for fire barriers shall be protected to afford the required fire-resistance rating of the fire barrier supported, except for 1-hour fire-resistance-rated incidental use area separations as required by Table 508.2 in buildings of Type IIB, IIIB and VB construction. Hollow vertical spaces within a fire barrier shall be fireblocked in accordance with Section 717.2 at every floor level.

Exceptions:

1. The maximum required fire-resistance rating for assemblies supporting fire barriers separating tank storage as provided for in Section 415.6.2.1 shall be 2 hours, but not less than required by Table 601 for the building construction type.
2. Shaft enclosures shall be permitted to terminate at a top enclosure complying with Section 707.12.

706.6 Exterior walls. Where exterior walls serve as a part of a required fire-resistance-rated enclosure or separation, such walls shall comply with the requirements of Section 704 for exterior walls, and the fire-resistance-rated enclosure or separation requirements shall not apply.

Exception: Exterior walls required to be fire-resistance rated in accordance with Section 1014.5.1 for exterior egress balconies, Section 1020.1.4 for exit enclosures and Section 1023.6 for exterior exit ramps and stairways.

706.7 Openings. Openings in a fire barrier wall shall be protected in accordance with Section 715. Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and a maximum area of any single opening shall not exceed 156 square feet (15 m^2). Openings in exit enclosures and exit passageways shall also comply with Sections 1020.1.1 and 1021.4, respectively.

Exceptions:

1. Openings shall not be limited to 156 square feet (15 m^2) where adjoining fire areas are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Fire doors serving an exit enclosure.
3. Openings shall not be limited to 156 square feet (15 m^2) or an aggregate width of 25 percent of the length of the wall where the opening protective assembly has been tested in accordance with ASTM E 119 and has a minimum fire-resistance rating not less than the fire-resistance rating of the wall.
4. Fire windows permitted in atrium separation walls shall not be limited to a maximum aggregate width of 25 percent of length of the wall.

706.8 Penetrations. Penetrations of fire barriers shall comply with Section 712.

706.8.1 Prohibited penetrations. Penetrations into an exit enclosure or an exit passageway shall be allowed only when permitted by Section 1020.1.2 or 1021.5, respectively.

706.9 Joints. Joints made in or between fire barriers shall comply with Section 713.

706.10 Ducts and air transfer openings. Penetrations in a fire barrier by ducts and air transfer openings shall comply with Section 716.

SECTION 707
SHAFT ENCLOSURES

707.1 General. The provisions of this section shall apply to vertical shafts where such shafts are required to protect openings and penetrations through floor/ceiling and roof/ceiling assemblies. Shaft enclosures shall be constructed as fire barriers in accordance with Section 706 or horizontal assemblies in accordance with Section 711, or both.

707.2 Shaft enclosure required. Openings through a floor/ceiling assembly shall be protected by a shaft enclosure complying with this Section.

Exceptions:

1. A shaft enclosure is not required for openings totally within an individual residential dwelling unit and connecting four stories or less.
2. A shaft enclosure is not required in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 for an escalator opening or stairway that is not a portion of the means of egress protected according to Item 2.1 or 2.2:
   - 2.1. Where the area of the floor opening between stories does not exceed twice the horizontal projected area of the escalator or stairway and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Groups B and M, this application is limited to openings that do not connect more than four stories.
   - 2.2. Where the opening is protected by approved power-operated automatic shutters at every penetrated floor. The shutters shall be of noncombustible construction and have a fire-resistance rating of not less than 1.5 hours. The shutter shall be so constructed as to close immediately upon the actuation of a smoke detector installed in accordance with Section 907.11 and shall completely shut off the well opening. Escalators shall cease operation when the shutter begins to close. The shutter shall operate at a speed of not more than 30 feet per minute (152.4 mm/s) and shall be equipped with a sensitive leading edge to arrest its progress where in contact with any obstacle, and to continue its progress on release therefrom.
3. A shaft enclosure is not required for penetrations by pipe, tube, conduit, wire, cable and vents protected in accordance with Section 712.4.
4. A shaft enclosure is not required for penetrations by ducts protected in accordance with Section 712.4. Grease ducts shall be protected in accordance with the *Florida Building Code, Mechanical*.
5. In other than Group H occupancies, a shaft enclosure is not required for floor openings complying with the provisions for atriums in Section 404.
6. A shaft enclosure is not required for approved masonry chimneys where annular space protection is provided at each floor level in accordance with Section 717.2.5.
7. In other than Groups I-2 and I-3, a shaft enclosure is not required for a floor opening or an air transfer opening that complies with the following:
   - 7.1. Does not connect more than two stories.
   - 7.2. Is not part of the required means of egress system, except as permitted in Section 1020.1.
   - 7.3. Is not concealed within the building construction.
   - 7.4. Is not open to a corridor in Group I and R occupancies.
   - 7.5. Is not open to a corridor on nonsprinklered floors in any occupancy.
   - 7.6. Is separated from floor openings and air transfer openings serving other floors by construction conforming to required shaft enclosures.
   - 7.7. Is limited to the same smoke compartment.
8. A shaft enclosure is not required for automobile ramps in open and enclosed parking garages constructed in accordance with Sections 406.3 and 406.4, respectively.
9. A shaft enclosure is not required for floor openings between a mezzanine and the floor below.
10. A shaft enclosure is not required for joints protected by a fire-resistant joint system in accordance with Section 713.
11. A shaft enclosure shall not be required for floor openings created by unenclosed stairs or ramps in accordance with Exception 8 or 9 in Section 1020.1.
12. Floor openings protected by floor fire door assemblies in accordance with Section 711.8.
13. Where permitted by other sections of this code.

707.3 Materials. The shaft enclosure shall be of materials permitted by the building type of construction.

707.4 Fire-resistance rating. Shaft enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more, and not less than 1 hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.

707.5 Continuity. Shaft enclosures shall be constructed as fire barriers in accordance with Section 706 or horizontal assemblies constructed in accordance with Section 711, or both, and

shall have continuity in accordance with Section 706.5 for fire barriers or Section 711.4 for horizontal assemblies as applicable.

707.6 Exterior walls. Where exterior walls serve as a part of a required shaft enclosure, such walls shall comply with the requirements of Section 704 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

Exception: Exterior walls required to be fire-resistance rated in accordance with Section 1014.5.1 for exterior egress balconies, Section 1020.1.4 for exit enclosures and Section 1023.6 for exterior exit ramps and stairways.

707.7 Openings. Openings in a shaft enclosure shall be protected in accordance with Section 715 as required for fire barriers. Doors shall be self- or automatic closing by smoke detection in accordance with Section 715.4.7.3.

707.7.1 Prohibited openings. Openings other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

707.8 Penetrations. Penetrations in a shaft enclosure shall be protected in accordance with Section 712 as required for fire barriers.

707.8.1 Prohibited penetrations. Penetrations other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

707.9 Joints. Joints in a shaft enclosure shall comply with Section 713.

707.10 Ducts and air transfer openings. Penetrations of a shaft enclosure by ducts and air transfer openings shall comply with Section 716.

707.11 Enclosure at the bottom. Shafts that do not extend to the bottom of the building or structure shall:

1. Be enclosed at the lowest level with construction of the same fire-resistance rating as the lowest floor through which the shaft passes, but not less than the rating required for the shaft enclosure;
2. Terminate in a room having a use related to the purpose of the shaft. The room shall be separated from the remainder of the building by a fire barrier having a fire-resistance rating and opening protectives at least equal to the protection required for the shaft enclosure; or
3. Be protected by approved fire dampers installed in accordance with their listing at the lowest floor level within the shaft enclosure.

Exceptions:

1. The fire-resistance-rated room separation is not required, provided there are no openings in or penetrations of the shaft enclosure to the interior of the building except at the bottom. The bottom of the shaft shall be closed off around the penetrating items with materials permitted by Section 717.3.1 for draftstopping, or the room shall be provided with an approved automatic fire suppression system.
2. A shaft enclosure containing a refuse chute or laundry chute shall not be used for any other purpose and shall terminate in a room protected in accordance with Section 707.13.4.
3. The fire-resistance-rated room separation and the protection at the bottom of the shaft are not required, provided there are no combustibles in the shaft and there are no openings or other penetrations through the shaft enclosure to the interior of the building.

707.12 Enclosure at the top. A shaft enclosure that does not extend to the underside of the roof sheathing, deck or slab of the building shall be enclosed at the top with construction of the same fire-resistance rating as the topmost floor penetrated by the shaft, but not less than the fire-resistance rating required for the shaft enclosure.

707.13 Refuse and laundry chutes. Refuse and laundry chutes, access and termination rooms and incinerator rooms shall meet the requirements of Sections 707.13.1 through 707.13.6.

Exception: Chutes serving and contained within a single dwelling unit.

707.13.1 Refuse and laundry chute enclosures. A shaft enclosure containing a refuse or laundry chute shall not be used for any other purpose and shall be enclosed in accordance with Section 707.4. Openings into the shaft, including those from access rooms and termination rooms, shall be protected in accordance with this section and Section 715. Openings into chutes shall not be located in corridors. Doors shall be self- or automatic closing upon the actuation of a smoke detector in accordance with Section 715.4.7.3, except that heat-activated closing devices shall be permitted between the shaft and the termination room.

707.13.2 Materials. A shaft enclosure containing a refuse or laundry chute shall be constructed of materials as permitted by the building type of construction.

707.13.3 Refuse and laundry chute access rooms. Access openings for refuse and laundry chutes shall be located in rooms or compartments enclosed by a fire barrier that has a fire-resistance rating of not less than 1 hour. Openings into the access rooms shall be protected by opening protectives having a fire protection rating of not less than $^3/_4$ hour. Doors shall be self- or automatic closing upon the detection of smoke in accordance with Section 715.4.7.3.

707.13.4 Termination room. Refuse and laundry chutes shall discharge into an enclosed room separated from the remainder of the building by a fire barrier that has a fire-resistance rating of not less than 1 hour. Openings into the termination room shall be protected by opening protectives having a fire protection rating of not less than $^3/_4$ hour. Doors shall be self- or automatic closing upon the detection of smoke in accordance with Section 715.4.7.3. Refuse chutes shall not terminate in an incinerator room. Refuse and laundry rooms that are not provided with chutes need only comply with Table 508.2.

707.13.5 Incinerator room. Incinerator rooms shall comply with Table 508.2.

707.13.6 Automatic sprinkler system. An approved automatic sprinkler system shall be installed in accordance with Section 903.2.10.2.

707.14 Elevator, dumbwaiter and other hoistways. Elevator, dumbwaiter and other hoistway enclosures shall be constructed in accordance with Section 707 and Chapter 30.

707.14.1 Elevator lobby. An enclosed elevator lobby shall be provided at each floor where an elevator shaft enclosure connects more than three stories. The lobby shall separate the elevator shaft enclosure doors from each floor by fire partitions equal to the fire-resistance rating of the corridor and the required opening protection. Elevator lobbies shall have at least one means of egress complying with Chapter 10 and other provisions within this code.

Exceptions:

1. Enclosed elevator lobbies are not required at the street floor, provided the entire street floor is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Elevators not required to be located in a shaft in accordance with Section 707.2 are not required to have enclosed elevator lobbies.
3. Where additional doors are provided at the hoistway opening in accordance with Section 3002.6. Such doors shall be tested in accordance with UL 1784 without an artificial bottom seal.
4. In other than Group I-3, and buildings having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access, enclosed elevator lobbies are not required where the building is protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
5. Smoke partitions shall be permitted in lieu of fire partitions to separate the elevator lobby at each floor where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
6. Enclosed elevator lobbies are not required where the elevator hoistway is pressurized in accordance with Section 707.14.2.

707.14.2 Enclosed elevator lobby pressurization alternative. Where elevator hoistway pressurization is provided in lieu of required enclosed elevator lobbies, the pressurization system shall comply with this section.

707.14.2.1 Pressurization requirements. Elevator hoistways shall be pressurized to maintain a minimum positive pressure of 0.04 inches of water column (1.0 Pa) and a maximum positive pressure of 0.06 inches of water column (1.49 Pa) with respect to adjacent occupied space on all floors. This pressure shall be measured at the midpoint of each hoistway door, with all ground floor level hoistway doors open and all other hoistway doors closed. The supply air intake shall be from an outside, uncontaminated source located a minimum distance of 20 feet (6096 mm) from any air exhaust system or outlet.

707.14.2.2 Ducts for system. Any duct system that is part of the pressurization system shall be protected with the same fire-resistance rating as required for the elevator shaft enclosure.

707.14.2.3 Fan system. The fan system provided for the pressurization system shall be as required by this section.

707.14.2.3.1 Fire resistance. When located within the building, the fan system that provides the pressurization shall be protected with the same fire-resistance rating required for the elevator shaft enclosure.

707.14.2.3.2 Smoke detection. The fan system shall be equipped with a smoke detector that will automatically shut down the fan system when smoke is detected within the system.

707.14.2.3.3 Separate systems. A separate fan system shall be used for each bank of elevators.

707.14.2.3.4 Fan capacity. The supply fan shall either be adjustable with a capacity of at least 1,000 cfm (.4719 m^3/s) per door, or that specified by a registered design professional to meet the requirements of a designed pressurization system.

707.14.2.4 Standby power. The pressurization system shall be provided with standby power from the same source as other required emergency systems for the building.

707.14.2.5 Activation of pressurization system. The elevator pressurization system shall be activated upon activation of the building fire alarm system or upon activation of the elevator lobby smoke detectors.

SECTION 708
FIRE PARTITIONS

708.1 General. The following wall assemblies shall comply with this section:

1. Walls separating dwelling units in the same building.
2. Walls separating sleeping units in occupancies in Group R-1 hotel, R-2 and I-1 occupancies.
3. Walls separating tenant spaces in covered mall buildings as required by Section 402.7.2.
4. Corridor walls as required by Section 1016.1.
5. Elevator lobby separation as required by Section 707.14.1.
6. Residential aircraft hangars.
7. Wall separating individual tenant spaces.

Exceptions:

1. In Group B and S occupancies, walls used to separate tenants shall not be required to have a fire-resistance rating, provided no area between fire partitions having a 1-hour fire-resistance rating exceeds 3,000 square feet (279 m^2).

2. In aircraft hangar occupancies, walls used to separate tenants shall not be required to have a fire-resistance rating, provided the aircraft hanger is constructed in accordance with the requirements of Section 412.2.
3. In mini-warehouses/self-storage buildings, walls used to separate tenants shall not be required to have fire-resistance rating, provided a sprinkler system meeting the requirements of Ordinary Hazard Group II as defined by NFPA 13, is installed employing quick response heads.

708.2 Materials. The walls shall be of materials permitted by the building type of construction.

708.3 Fire-resistance rating. Fire partitions shall have a fire-resistance rating of not less than 1 hour.

Exceptions:

1. Corridor walls as permitted by Table 1017.1.
2. Dwelling and sleeping unit separations in buildings of Type IIB, IIIB and VB construction shall have fire-resistance ratings of not less than $^1/_2$ hour in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

708.4 Continuity. Fire partitions shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above or to the fire-resistance-rated floor/ceiling or roof/ceiling assembly above, and shall be securely attached thereto. If the partitionsare not continuous to the sheathing, deck or slab, and where constructed of combustible construction, the space between the ceiling and the sheathing, deck or slab above shall be fireblocked or draftstopped in accordance with Sections 717.2 and 717.3 at the partition line. The supporting construction shall be protected to afford the required fire-resistance rating of the wall supported, except for tenant and sleeping unit separation walls and corridor walls in buildings of Types IIB, IIIB and VB construction.

Exceptions:

1. The wall need not be extended into the crawl space below where the floor above the crawl space has a minimum 1-hour fire-resistance rating.
2. Where the room-side fire-resistance-rated membrane of the corridor is carried through to the underside of the floor or roof sheathing, deck or slab of a fire-resistance-rated floor or roof above, the ceiling of the corridor shall be permitted to be protected by the use of ceiling materials as required for a 1-hour fire-resistance-rated floor or roof system.
3. Where the corridor ceiling is constructed as required for the corridor walls, the walls shall be permitted to terminate at the upper membrane of such ceiling assembly.
4. The fire partition separating tenant spaces in a mall, complying with Section 402.7.2, are not required to extend beyond the underside of a ceiling that is not part of a fire-resistance-rated assembly. A wall is not required in attic or ceiling spaces above tenant separation walls.
5. Fireblocking or draftstopping is not required at the partition line in Group R-2 buildings that do not exceed four stories in height, provided the attic space is subdivided by draftstopping into areas not exceeding 3,000 square feet (279 m^2) or above every two dwelling units, whichever is smaller.
6. Fireblocking or draftstopping is not required at the partition line in buildings equipped with an automatic sprinkler system installed throughout in accordance with Section 903.3.1.1 or 903.3.1.2, provided that automatic sprinklers are installed in combustible floor/ceiling and roof/ceiling spaces.

708.4.1 Roof Construction. When the fire partition is continuous to the underside of the roof sheathing in occupancies of Groups R-1, R-2 and R-3 as applicable in Section 101.2, in Type III, IV and V construction the following shall be provided:

708.4.1.1 Roof Sheathing. The roof sheathing or deck shall be of approved noncombustible materials or of fire-retardant-treated wood, for a distance of 4 feet (1220 mm); or

708.4.1.2 Roof Protection. The roof shall be protected with 0.625-inch (15.88 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a minimum distance of 4 feet (1220 mm).

708.5 Exterior walls. Where exterior walls serve as a part of a required fire-resistance-rated separation, such walls shall comply with the requirements of Section 704 for exterior walls, and the fire-resistance-rated separation requirements shall not apply.

Exception: Exterior walls required to be fire-resistance rated in accordance with Section 1014.5.1 for exterior egress balconies, Section 1020.1.4 for exit enclosures and Section 1023.6 for exterior exit ramps and stairways.

708.6 Openings. Openings in a fire partition shall be protected in accordance with Section 715.

708.7 Penetrations. Penetrations of fire partitions shall comply with Section 712.

708.8 Joints. Joints made in or between fire partitions shall comply with Section 713.

708.9 Ducts and air transfer openings. Penetrations in a fire partition by ducts and air transfer openings shall comply with Section 716.

SECTION 709
SMOKE BARRIERS

709.1 General. Smoke barriers shall comply with this section.

709.2 Materials. Smoke barriers shall be of materials permitted by the building type of construction.

709.3 Fire-resistance rating. A 1-hour fire-resistance rating is required for smoke barriers.

Exception: Smoke barriers constructed of minimum 0.10-inch-thick (2.5 mm) steel in Group I-3 buildings.

709.4 Continuity. Smoke barriers shall form an effective membrane continuous from outside wall to outside wall and from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, deck or slab above, including continuity through concealed spaces, such as those found above suspended ceilings, and interstitial structural and mechanical spaces. The supporting construction shall be protected to afford the required fire-resistance rating of the wall or floor supported in buildings of other than Type IIB, IIIB or VB construction.

Exception: Smoke-barrier walls are not required in interstitial spaces where such spaces are designed and constructed with ceilings that provide resistance to the passage of fire and smoke equivalent to that provided by the smoke-barrier walls.

709.5 Openings. Openings in a smoke barrier shall be protected in accordance with Section 715.

Exception: In Group I-2, where doors are installed across corridors, a pair of opposite-swinging doors without a center mullion shall be installed having vision panels with fire-protection-rated glazing materials in fire-protection-rated frames, the area of which shall not exceed that tested. The doors shall be close fitting within operational tolerances, and shall not have undercuts, louvers or grilles. The doors shall have head and jamb stops, astragals or rabbets at meeting edges and shall be automatic closing by smoke detection in accordance with Section 715.4.7.3. Positive-latching devices are not required.

709.6 Penetrations. Penetrations of smoke barriers shall comply with Section 712.

709.7 Joints. Joints made in or between smoke barriers shall comply with Section 713.

709.8 Ducts and air transfer openings. Penetrations in a smoke barrier by ducts and air transfer openings shall comply with Section 716.

SECTION 710
SMOKE PARTITIONS

710.1 General. Smoke partitions installed as required elsewhere in the code shall comply with this section.

710.2 Materials. The walls shall be of materials permitted by the building type of construction.

710.3 Fire-resistance rating. Unless required elsewhere in the code, smoke partitions are not required to have a fire-resistance rating.

710.4 Continuity. Smoke partitions shall extend from the top of the foundation or floor below to the underside of the floor or roof sheathing, deck or slab above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke.

710.5 Openings. Windows shall be sealed to resist the free passage of smoke or be automatic-closing upon detection of smoke. Doors in smoke partitions shall comply with this section.

710.5.1 Louvers. Doors in smoke partitions shall not include louvers.

710.5.2 Smoke and draft control doors. Where required elsewhere in the code, doors in smoke partitions shall be tested in accordance with UL 1784 with an artificial bottom seal installed across the full width of the bottom of the door assembly during the test. The air leakage rate of the door assembly shall not exceed 3 cubic feet per minute per square foot [$ft^3/(min \cdot ft^2)$](0.015424 $m^3/s \cdot m^2$) of door opening at 0.10 inch (24.9Pa) of water for both the ambient temperature test and the elevated temperature exposure test.

710.5.3 Self- or automatic-closing doors. Where required elsewhere in the code, doors in smoke partitions shall be self- or automatic closing by smoke detection in accordance with Section 715.4.7.3.

710.6 Penetrations and joints. The space around penetrating items and in joints shall be filled with an approved material to limit the free passage of smoke.

710.7 Ducts and air transfer openings. The space around a duct penetrating a smoke partition shall be filled with an approved material to limit the free passage of smoke. Air transfer openings in smoke partitions shall be provided with a smoke damper complying with Section 716.3.2.

Exception: Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized.

SECTION 711
HORIZONTAL ASSEMBLIES

711.1 General. Floor and roof assemblies required to have a fire-resistance rating shall comply with this section.

711.2 Materials. The floor and roof assemblies shall be of materials permitted by the building type of construction.

711.3 Fire-resistance rating. The fire-resistance rating of floor and roof assemblies shall not be less than that required by the building type of construction. Where the floor assembly separates mixed occupancies, the assembly shall have a fire-resistance rating of not less than that required by Section 508.3.3 based on the occupancies being separated. Where the floor assembly separates a single occupancy into different fire areas, the assembly shall have a fire-resistance rating of not less than that required by Section 706.3.9. Floor assemblies separating dwelling units in the same building or sleeping units in occupancies in Group R-1, hotel occupancies, R-2 and I-1; and floor assemblies separating individual tenant spaces in the same building in all other occupancies shall be a minimum of 1-hour fire-resistance-rated construction.

Exceptions:

1. Dwelling unit and sleeping unit separations in buildings of Type IIB, IIIB, and VB construction shall have fire-resistance ratings of not less than ½ hour in build-

ings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2. Individual tenant space separations in buildings of Type IIB, IIIB and VB construction in covered mall buildings are not required to have a fire-resistance rating.

711.3.1 Ceiling panels. Where the weight of lay-in ceiling panels, used as part of fire-resistance-rated floor/ceiling or roof/ceiling assemblies, is not adequate to resist an upward force of 1 lb/ft.^{2} (48 Pa), wire or other approved devices shall be installed above the panels to prevent vertical displacement under such upward force.

711.3.2 Access doors. Access doors shall be permitted in ceilings of fire-resistance-rated floor/ceiling and roof/ceiling assemblies provided such doors are tested in accordance with ASTM E 119 as horizontal assemblies and labeled by an approved agency for such purpose.

711.3.3 Unusable space. In 1-hour fire-resistance-rated floor construction, the ceiling membrane is not required to be installed over unusable crawl spaces. In 1-hour fire-resistance-rated roof construction, the floor membrane is not required to be installed where unusable attic space occurs above.

711.4 Continuity. Assemblies shall be continuous without openings, penetrations or joints except as permitted by this section and Sections 707.2, 712.4, 713 and 1020.1. Skylights and other penetrations through a fire-resistance-rated roof deck or slab are permitted to be unprotected, provided that the structural integrity of the fire-resistance-rated roof construction is maintained. Unprotected skylights shall not be permitted in roof construction required to be fire-resistance rated in accordance with Section 704.10. The supporting construction shall be protected to afford the required fire-resistance rating of the horizontal assembly supported.

711.5 Penetrations. Penetrations of fire-resistance-rated horizontal assemblies shall comply with Section 712.

711.6 Joints. Joints made in or between fire-resistance-rated horizontal assemblies shall comply with Section 713. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 713.4.

711.7 Ducts and air transfer openings. Penetrations in horizontal assemblies by ducts and air transfer openings shall comply with Section 716.

711.8 Floor fire door assemblies. Floor fire door assemblies used to protect openings in fire-resistance-rated floors shall be tested in accordance with NFPA 288, and shall achieve a fire-resistance rating not less than the assembly being penetrated. Floor fire door assemblies shall be labeled by an approved agency. The label shall be permanently affixed and shall specify the manufacturer, the test standard and the fire-resistance rating.

SECTION 712
PENETRATIONS

712.1 Scope. The provisions of this section shall govern the materials and methods of construction used to protect through penetrations and membrane penetrations of horizontal assemblies and fire-resistance-rated wall assemblies.

712.2 Installation details. Where sleeves are used, they shall be securely fastened to the assembly penetrated. The space between the item contained in the sleeve and the sleeve itself and any space between the sleeve and the assembly penetrated shall be protected in accordance with this section. Insulation and coverings on or in the penetrating item shall not penetrate the assembly unless the specific material used has been tested as part of the assembly in accordance with this section.

712.3 Fire-resistance-rated walls. Penetrations into or through fire walls, fire-barrier walls, smoke-barrier walls and fire partitions shall comply with Sections 712.3.1 through 712.3.4.

712.3.1 Through penetrations. Through penetrations of fire-resistance-rated walls shall comply with Section 712.3.1.1 or 712.3.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space between the penetrating item and the fire-resistance-rated wall is permitted to be protected as follows:

1. In concrete or masonry walls where the penetrating item is a maximum 6-inch (152 mm) nominal diameter and the area of the opening through the wall does not exceed 144 square inches (0.0929 m^2), concrete, grout or mortar is permitted where it is installed the full thickness of the wall or the thickness required to maintain the fire-resistance rating; or
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

712.3.1.1 Fire-resistance-rated assemblies. Penetrations shall be installed as tested in an approved fire-resistance-rated assembly.

712.3.1.2 Through-penetration firestop system. Through penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water and shall have an F rating of not less than the required fire-resistance rating of the wall penetrated.

712.3.2 Membrane penetrations. Membrane penetrations shall comply with Section 712.3.1. Where walls or partitions are required to have a fire-resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced.

Exceptions:

1. Membrane penetrations of maximum two-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m^2) in area, provided the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m^2) in any 100 square feet (9.29 m^2) of wall area. The annular space between the wall membrane and the box shall not exceed $^1/_8$ inch (3.1 mm). Such boxes on opposite sides of the wall or partition shall be separated by one of the following:
   1.1. By a horizontal distance of not less than 24 inches (610 mm);
   1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation;
   1.3. By solid fireblocking in accordance with Section 717.2.1;
   1.4. By protecting both boxes with listed putty pads; or
   1.5. By other listed materials and methods.
2. Membrane penetrations by listed electrical boxes of any material, provided such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the wall membrane and the box shall not exceed $^1/_8$ inch (3.1 mm) unless listed otherwise. Such boxes on opposite sides of the wall or partition shall be separated as follows:
   2.1. By a horizontal distance of not less than 24 inches (610 mm);
   2.2. By solid fireblocking in accordance with Section 717.2.1;
   2.3. By protecting both boxes with listed putty pads; or
   2.4. By other listed materials and methods.
3. The annular space created by the penetration of an automatic sprinkler, provided it is covered by a metal escutcheon plate.

712.3.3 Ducts and air transfer openings. Penetrations of fire-resistance-rated walls by ducts that are not protected with dampers shall comply with Sections 712.2 through 712.3.1. Ducts and air transfer openings that are protected with dampers shall comply with Section 716.

712.3.4 Dissimilar materials. Noncombustible penetrating items shall not connect to combustible items beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the wall is maintained.

712.4 Horizontal assemblies. Penetrations of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected in accordance with Section 707.

712.4.1 Fire-resistance rated assemblies. Penetrations of the fire-resistance rated floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall comply with Sections 712.4.1.1 through 712.4.1.4.

712.4.1.1 Through penetrations. Through penetrations of fire-resistance-rated horizontal assemblies shall comply with Section 712.4.1.1.1 or 712.4.1.1.2.

Exceptions:

1. Penetrations by steel, ferrous or copper conduits, pipes, tubes or vents or concrete or masonry items through a single fire-resistance-rated floor assembly where the annular space is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated. Penetrating items with a maximum 6-inch (152 mm) nominal diameter shall not be limited to the penetration of a single fire-resistance-rated floor assembly, provided the aggregate area of the openings through the assembly does not exceed 144 square inches (92 900 mm^2) in any 100 square feet (9.3 m^2) of floor area.
2. Penetrations in a single concrete floor by steel, ferrous or copper conduits, pipes, tubes or vents with a maximum 6-inch (152 mm) nominal diameter, provided the concrete, grout or mortar is installed the full thickness of the floor or the thickness required to maintain the fire-resistance rating. The penetrating items shall not be limited to the penetration of a single concrete floor, provided the area of the opening through each floor does not exceed 144 square inches (92 900 mm^2).
3. Penetrations by listed electrical boxes of any material, provided such boxes have been tested for use in fire-resistance-rated assemblies and installed in accordance with the instructions included in the listing.

712.4.1.1.1 Installation. Through penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

712.4.1.1.2 Through-penetration firestop system. Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (2.49 Pa). The system shall have an F-rating and a T-rating of not less than 1 hour but not less than the required rating of the floor penetrated.

Exception: Floor penetrations contained and located within the cavity of a wall do not require a T- rating.

712.4.1.2 Membrane penetrations. Penetrations of membranes that are part of a fire-resistance-rated horizontal assembly shall comply with Section 712.4.1.1.1 or 712.4.1.1.2. Where floor/ceiling assemblies are required to have a minimum 1-hour fire-resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced.

Exceptions:

1. Membrane penetrations by steel, ferrous or copper conduits, pipes, tubes or vents, or concrete or masonry items where the annular space is protected either in accordance with Section 712.4.1.1 or to prevent the free passage of flame and the products of combustion. The aggregate area of the openings through the membrane shall not exceed 100 square inches (64 500 mm^2) in any 100 square feet (9.3 m^2) of ceiling area in assemblies tested without penetrations.
2. Ceiling membrane penetrations of maximum 2-hour fire-resistance-rated horizontal assemblies by steel electrical boxes that do not exceed 16 square inches (10 323 mm^2) in area, provided the aggregate area of such penetrations does not exceed 100 square inches (44 500 mm^2) in any 100 square feet (9.29 m^2) of ceiling area, and the annular space between the ceiling membrane and the box does not exceed $^1/_8$ inch (3.12 mm).
3. Membrane penetrations by listed electrical boxes of any material, provided such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the ceiling membrane and the box shall not exceed $^1/_8$ inch (3.1 mm) unless listed otherwise.
4. The annular space created by the penetration of a fire sprinkler, provided it is covered by a metal eschutcheon plate.

712.4.1.3 Ducts and air transfer openings. Penetrations of horizontal assemblies by ducts and air transfer openings shall comply with Section 716.

712.4.1.4 Dissimilar materials. Noncombustible penetrating items shall not connect to combustible materials beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the horizontal assembly is maintained.

712.4.2 Nonfire-resistance-rated assemblies. Penetrations of horizontal assemblies without a required fire-resistance rating shall meet the requirements of Section 707 or shall comply with Section 712.4.2.1 or 712.4.2.2.

712.4.2.1 Noncombustible penetrating items. Noncombustible penetrating items that connect not more than three stories are permitted, provided that the annular space is filled with an approved noncombustible material to resist the free passage of flame and the products of combustion.

712.4.2.2 Penetrating items. Penetrating items that connect not more than two stories are permitted, provided that the annular space is filled with an approved material to resist the free passage of flame and the products of combustion.

712.5 Penetrations in smoke barriers. Penetrations in smoke barriers shall be tested in accordance with the requirements of UL 1479 for air leakage. The air leakage rate of the penetration assembly shall not exceed 5.0 cfm per square foot (0.025 $m^3/s \cdot m^2$) of penetration opening at 0.30 inch (7.47 Pa) of water for both the ambient temperature and elevated temperature tests.

712.6 Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings shall be effectively and permanently identified with signs or stenciling in a manner acceptable to the Authority having Jurisdiction. Such identification shall be above any decorative ceiling and in concealed spaces. Suggested wording for fire and smoke barriers: "FIRE AND SMOKE BARRIER – PROTECT ALL OPENINGS."

SECTION 713
FIRE-RESISTANT JOINT SYSTEMS

713.1 General. Joints installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which it is installed. Fire-resistant joint systems shall be tested in accordance with Section 713.3. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 713.4.

Exception: Fire-resistant joint systems shall not be required for joints in all of the following locations:

1. Floors within a single dwelling unit.
2. Floors where the joint is protected by a shaft enclosure in accordance with Section 707.
3. Floors within atriums where the space adjacent to the atrium is included in the volume of the atrium for smoke control purposes.
4. Floors within malls.
5. Floors within open parking structures.
6. Mezzanine floors.
7. Walls that are permitted to have unprotected openings.
8. Roofs where openings are permitted.
9. Control joints not exceeding a maximum width of 0.625 inch (15.9 mm) and tested in accordance with ASTM E 119.

713.2 Installation. Fire-resistant joint systems shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gases.

713.3 Fire test criteria. Fire-resistant joint systems shall be tested in accordance with the requirements of either ASTM E 1966 or UL 2079. Nonsymmetrical wall joint systems shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests. When evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side.

Exception: For exterior walls with a horizontal fire separation distance greater than 5 feet (1524 mm), the joint system shall be required to be tested for interior fire exposure only.

713.4 Exterior curtain wall/floor intersection. Where fire resistance-rated floor or floor/ceiling assemblies are required, voids created at the intersection of the exterior curtain wall assemblies and such floor assemblies shall be sealed with an approved material or system to prevent the interior vertical spread of fire. Such material or systems shall be securely installed and capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste where subjected either to ASTM E 119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch of water column (2.5 Pa) or installed as tested in accordance with ASTM E 2307 for the time period at least equal to the fire-resistance rating of the floor assembly. Height and fire-resistance requirements for curtain wall spandrels shall comply with Section 704.9.

713.5 Spandrel wall. Height and fire-resistance requirements for curtain wall spandrels shall comply with Section 704.9. Where Section 704.9 does not require a fire-resistance-rated spandrel wall, the requirements of Section 713.4 shall still apply to the intersection between the spandrel wall and the floor.

713.6 Fire-resistant joint systems in smoke barriers. Fire-resistant joint systems in smoke barriers shall be tested in accordance with the requirements of UL 2079 for air leakage. The air leakage rate of the joint shall not exceed 5 cfm per lineal foot (0.00775 $m^3/s \cdot m$) of joint at 0.30 inch (7.47 Pa) of water for both the ambient temperature and elevated temperature tests.

SECTION 714
FIRE-RESISTANCE RATING OF STRUCTURAL MEMBERS

714.1 Requirements. The fire-resistance rating of structural members and assemblies shall comply with the requirements for the type of construction and shall not be less than the rating required for the fire-resistance-rated assemblies supported.

Exception: Fire barriers, fire partitions and smoke barriers as provided in Sections 706.5, 708.4 and 709.4, respectively.

714.2 Protection of structural members. Protection of columns, girders, trusses, beams, lintels or other structural members that are required to have a fire-resistance rating shall comply with this section.

714.2.1 Individual protection. Columns, girders, trusses, beams, lintels or other structural members that are required to have a fire-resistance rating and that support more than two floors or one floor and roof, or support a load-bearing wall or a nonload-bearing wall more than two stories high, shall be individually protected on all sides for the full length with materials having the required fire-resistance rating. Other structural members required to have a fire-resistance rating shall be protected by individual encasement, by a membrane or ceiling protection as specified in Section 711, or by a combination of both. Columns shall also comply with Section 714.2.2.

714.2.1.1 Membrane protection. King studs and boundary elements that are integral elements in load-bearing walls of light-framed construction shall be permitted to have required fire-resistance ratings provided by the membrane protection provided for the load-bearing wall.

714.2.2 Column protection above ceilings. Where columns require a fire-resistance rating, the entire column, including its connections to beams or girders, shall be protected. Where the column extends through a ceiling, fire resistance of the column shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.

714.2.3 Truss protection. The required thickness and construction of fire-resistance-rated assemblies enclosing trusses shall be based on the results of full-scale tests or combinations of tests on truss components or on approved calculations based on such tests that satisfactorily demonstrate that the assembly has the required fire resistance.

714.2.4 Attachments to structural members. The edges of lugs, brackets, rivets and bolt heads attached to structural members shall be permitted to extend to within 1 inch (25 mm) of the surface of the fire protection.

714.2.5 Reinforcing. Thickness of protection for concrete or masonry reinforcement shall be measured to the outside of the reinforcement except that stirrups and spiral reinforcement ties are permitted to project not more than 0.5-inch (12.7 mm) into the protection.

714.3 Embedments and enclosures. Pipes, wires, conduits, ducts or other service facilities shall not be embedded in the required fire protective covering of a structural member that is required to be individually encased.

714.4 Impact protection. Where the fire protective covering of a structural member is subject to impact damage from moving vehicles, the handling of merchandise or other activity, the fire protective covering shall be protected by corner guards or by a substantial jacket of metal or other noncombustible material to a height adequate to provide full protection, but not less than 5 feet (1524 mm) from the finished floor.

714.5 Exterior structural members. Load-bearing structural members located within the exterior walls or on the outside of a

building or structure shall be provided with the highest fire-resistance rating as determined in accordance with the following:

1. As required by Table 601 for the type of building element based on the type of construction of the building;
2. As required by Table 601 for exterior bearing walls based on the type of construction; and
3. As required by Table 602 for exterior walls based on the fire separation distance.

714.6 Bottom flange protection. Fire protection is not required at the bottom flange of lintels, shelf angles and plates, spanning not more than 6 feet (1829 mm) whether part of the structural frame or not, and from the bottom flange of lintels, shelf angles and plates not part of the structural frame, regardless of span.

714.7 Seismic isolation systems. Reserved.

SECTION 715
OPENING PROTECTIVES

715.1 General. Opening protectives required by other sections of this code shall comply with the provisions of this section.

715.2 Fire-resistance-rated glazing. Labeled fire-resistance-rated glazing tested as part of a fire-resistance-rated wall assembly in accordance with ASTM E 119 shall not be required to comply with this section.

715.3 Alternative methods for determining fire protection ratings. The application of any of the alternative methods listed in this section shall be based on the fire exposure and acceptance criteria specified in NFPA 252 or NFPA 257. The required fire resistance of an opening protective shall be permitted to be established by any of the following methods or procedures:

1. Designs documented in approved sources.
2. Calculations performed in an approved manner.
3. Engineering analysis based on a comparison of opening protective designs having fire-protection ratings as determined by the test procedures set forth in NFPA 252 or NFPA 257.
4. Alternative protection methods as allowed by Section 104.11.

715.4 Fire door and shutter assemblies. Approved fire door and fire shutter assemblies shall be constructed of any material or assembly of component materials that conforms to the test requirements of Section 715.4.1, 715.4.2 or 715.4.3 and the fire-protection rating indicated in Table 715.4. Fire door assemblies and shutters shall be installed in accordance with the provisions of this section and NFPA 80.

Exceptions:

1. Labeled protective assemblies that conform to the requirements of this section or UL 10A, UL 14B and UL 14C for tin-clad fire door assemblies.
2. Floor fire door assemblies in accordance with Section 711.8.

715.4.1 Side-hinged or pivoted swinging doors. Side-hinged and pivoted swinging doors shall be tested in accordance with NFPA 252 or UL 10C. After 5 minutes into the NFPA 252 test, the neutral pressure level in the furnace shall be established at 40 inches (1016 mm) or less above the sill.

TABLE 715.4
FIRE DOOR AND FIRE SHUTTER FIRE PROTECTION RATINGS

TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4 3 2 1 1/2	3 3[a] 1 1/2 1 1/2
Fire barriers having a required fire-resistance rating of 1 hour: Shaft, exit enclosure and exit passageway walls Other fire barriers	 1 1	 1 3/4
Fire partitions: Corridor walls Other fire partitions	 1 0.5 1 0.5	 1/3 [b] 1/3 [b] 3/4 1/3
Exterior walls	3 2 1	1 1/2 1 1/2 3/4
Smoke barriers	1	1/3 [b]

a. Two doors, each with a fire protection rating of 1 1/2 hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.
b. For testing requirements, see Section 715.4.3.

715.4.2 Other types of doors. Other types of doors, including swinging elevator doors, shall be tested in accordance with NFPA 252 or UL 10B. The pressure in the furnace shall be maintained as nearly equal to the atmospheric pressure as possible. Once established, the pressure shall be maintained during the entire test period.

715.4.3 Door assemblies in corridors and smoke barriers. Fire door assemblies required to have a minimum fire protection rating of 20 minutes where located in corridor walls or smoke-barrier walls having a fire-resistance rating in accordance with Table 715.4 shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test.

Exceptions:

1. Viewports that require a hole not larger than 1 inch (25 mm) in diameter through the door, have at least a 0.25-inch-thick (6.4 mm) glass disc and the holder is of metal that will not melt out where subject to temperatures of 1,700°F (927°C).
2. Corridor door assemblies in occupancies of Group I-2 shall be in accordance with Section 407.3.1.
3. Unprotected openings shall be permitted for corridors in multitheater complexes where each motion picture auditorium has at least one-half of its required exit or exit access doorways opening directly to the exterior or into an exit passageway.

715.4.3.1 Smoke and draft control. Fire door assemblies shall also meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784. Louvers shall be prohibited. Installation of smoke doors shall be in accordance with NFPA 105.

715.4.3.2 Glazing in door assemblies. In a 20-minute fire door assembly, the glazing material in the door itself shall have a minimum fire-protection rating of 20 minutes and shall be exempt from the hose stream test. Glazing material in any other part of the door assembly, including transom lites and sidelites, shall be tested in accordance with NFPA 257, including the hose stream test, in accordance with Section 715.5.

715.4.4 Doors in exit enclosures and exit passageways. Fire door assemblies in exit enclosures and exit passageways shall have a maximum transmitted temperature end point of not more than 450°F (250° C) above ambient at the end of 30 minutes of standard fire test exposure.

Exception: The maximum transmitted temperature rise is not limited in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

715.4.4.1 Glazing in doors. Fire-protection-rated glazing in excess of 100 square inches (0.065 m^2) shall be permitted in fire door assemblies when tested in accordance with NFPA 252 as components of the door assemblies and not as glass lights, and shall have a maximum transmitted temperature rise of 450°F (250°C) in accordance with Section 715.4.4.

Exception: The maximum transmitted temperature end point is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

715.4.5 Labeled protective assemblies. Fire door assemblies shall be labeled by an approved agency. The labels shall comply with NFPA 80, and shall be permanently affixed to the door or frame.

715.4.5.1 Fire door labeling requirements. Fire doors shall be labeled showing the name of the manufacturer, the name of the third-party inspection agency, the fire protection rating and, where required for fire doors in exit enclosures and exit passageways by Section 715.4.4, the maximum transmitted temperature end point. Smoke and draft control doors complying with UL 1784 shall be labeled as such. Labels shall be approved and permanently affixed. The label shall be applied at the factory or location where fabrication and assembly are performed.

715.4.5.2 Oversized doors. Oversized fire doors shall bear an oversized fire door label by an approved agency or shall be provided with a certificate of inspection furnished by an approved testing agency. When a certificate of inspection is furnished by an approved testing agency, the certificate shall state that the door conforms to the requirements of design, materials and construction, but has not been subjected to the fire test.

715.4.5.3 Smoke and draft control door labeling requirements. Smoke and draft control doors complying with UL 1784 shall be labeled in accordance with Section 715.4.5.1 and shall show the letter "S" on the fire rating label of the door. This marking shall indicate that the door and frame assembly are in compliance when listed or labeled gasketing is also installed.

715.4.5.4 Fire door frame labeling requirements. Fire door frames shall be labeled showing the names of the manufacturer and the third-party inspection agency.

715.4.6 Glazing material. Fire-protection-rated glazing conforming to the opening protection requirements in Section 715.4 shall be permitted in fire door assemblies.

715.4.6.1 Size limitations. Wired glass used in fire doors shall comply with Table 715.5.3. Other fire-protection-rated glazing shall comply with the size limitations of NFPA 80.

Exceptions:

1. Fire-protection-rated glazing in fire doors located in fire walls shall be prohibited except that where serving as a horizontal exit, a self-closing swinging door shall be permitted to have a vision panel of not more than 100 square inches (0.065 m^2) without a dimension exceeding 10 inches (254 mm).
2. Fire-protection-rated glazing shall not be installed in fire doors having a $1^1/_2$-hour fire protection rating intended for installation in fire barriers, unless the glazing is not more than 100 square inches (0.065 m^2) in area.

715.4.6.2 Exit and elevator protectives. Approved fire-protection-rated glazing used in fire door assemblies in elevator and exit enclosures shall be so located as to furnish clear vision of the passageway or approach to the elevator, ramp or stairway.

715.4.6.3 Labeling. Fire-protection-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and information required in Section 715.5.8.1 that shall be issued by an approved agency and shall be permanently affixed to the glazing.

715.4.6.3.1 Identification. For fire-protection-rated glazing, the label shall bear the following four-part identification: "D – H or NH – T or NT – XXX." "D" indicates that the glazing shall be used in fire door assemblies and that the glazing meets the fire resistance requirements of the test standard. "H" shall indicate that the glazing meets the hose stream requirements of the test standard. "NH" shall indicate that the glazing does not meet the hose stream requirements of the test. "T" shall indicate that the glazing meets the temperature requirements of Section 715.4.4.1. "NT" shall indicate that the glazing does not meet the temperature requirements of Section 715.4.4.1. The placeholder "XXX" shall specify the fire-protection-rating period, in minutes.

715.4.6.4 Safety glazing. Fire-protection-rated glazing installed in fire doors or fire window assemblies in areas subject to human impact in hazardous locations shall comply with Chapter 24.

715.4.7 Door closing. Fire doors shall be self- or automatic closing in accordance with this section.

Exceptions:

1. Fire doors located in common walls separating sleeping units in Group R-1 shall be permitted without automatic- or self-closing devices.
2. The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I emergency recall operation.

715.4.7.1 Latch required. Unless otherwise specifically permitted, single fire doors and both leaves of pairs of side-hinged swinging fire doors shall be provided with an active latch bolt that will secure the door when it is closed.

715.4.7.2 Automatic-closing fire door assemblies. Automatic-closing fire door assemblies shall be self-closing in accordance with NFPA 80.

715.4.7.3 Smoke-activated doors. Automatic-closing doors installed in the following locations shall be automatic closing by the actuation of smoke detectors installed in accordance with Section 907.10 or by loss of power to the smoke detector or hold-open device. Doors that are automatic closing by smoke detection shall not have more than a 10-second delay before the door starts to close after the smoke detector is actuated:

1. Doors installed across a corridor.
2. Doors that protect openings in exits or corridors required to be of fire-resistance-rated construction.
3. Doors that protect openings in walls that are capable of resisting the passage of smoke in accordance with Section 508.2.2.1.
4. Doors installed in smoke barriers in accordance with Section 709.5.
5. Doors installed in fire partitions in accordance with Section 708.6.
6. Doors installed in a fire wall in accordance with Section 705.8.
7. Doors installed in shaft enclosures in accordance with Section 707.7.
8. Doors installed in refuse and laundry chutes and access and termination rooms in accordance with Section 707.13.
9. Doors installed in the walls for compartmentation of underground buildings in accordance with Section 405.4.2.
10. Doors installed in the elevator lobby walls of underground buildings in accordance with Section 405.4.3.
11. Doors installed in smoke partitions in accordance with Section 710.5.3.

715.4.7.4 Doors in pedestrian ways. Vertical sliding or vertical rolling steel fire doors in openings through which pedestrians travel shall be heat activated or activated by smoke detectors with alarm verification.

715.4.8 Swinging fire shutters. Where fire shutters of the swinging type are installed in exterior openings, not less than one row in every three vertical rows shall be arranged to be readily opened from the outside, and shall be identified by distinguishing marks or letters not less than 6 inches (152 mm) high.

715.4.9 Rolling fire shutters. Where fire shutters of the rolling type are installed, such shutters shall include approved automatic-closing devices.

715.5 Fire-protection-rated glazing. Glazing in fire window assemblies shall be fire-protection rated in accordance with this section and Table 715.5. Glazing in fire door assemblies shall comply with Section 715.4.6. Fire-protection-rated glazing shall be tested in accordance with and shall meet the acceptance criteria of NFPA 257. Fire-protection-rated glazing shall also comply with NFPA 80. Openings in nonfire-resistance-rated exterior wall assemblies that require protection in accordance with Section 704.3, 704.8, 704.9 or 704.10 shall have a fire-protection rating of not less than $^3/_4$ hour.

Exceptions:

1. Wired glass in accordance with Section 715.5.3.

TABLE 715.5
FIRE WINDOW ASSEMBLY FIRE PROTECTION RATINGS

TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE WINDOW ASSEMBLY RATING (hours)
Interior walls:		
Fire walls	All	NP[a]
Fire barriers	> 1	NP[a]
Smoke barriers and fire partitions	1	3/4
Exterior walls	> 1	1 1/2
	1	3/4
Party wall	All	NP

NP = Not Permitted.
a. Not permitted except as specified in Section 715.2.

TABLE 715.5.3
LIMITING SIZES OF WIRED GLASS PANELS

OPENING FIRE PROTECTION RATING	MAXIMUM AREA (square inches)	MAXIMUM HEIGHT (inches)	MAXIMUM WIDTH (inches)
3 hours	0	0	0
1 1/2-hour doors in exterior walls	0	0	0
1 and 1 1/2 hours	100	33	10
3/4 hour	1,296	54	54
20 minutes	Not Limited	Not Limited	Not Limited
Fire window assemblies	1,296	54	54

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm^2.

2. Fire-protection-rated glazing in 0.5-hour fire-resistance-rated partitions is permitted to have an 0.33-hour fire-protection rating.

715.5.1 Testing under positive pressure. NFPA 257 shall evaluate fire-protection-rated glazing under positive pressure. Within the first 10 minutes of a test, the pressure in the furnace shall be adjusted so at least two-thirds of the test specimen is above the neutral pressure plane, and the neutral pressure plane shall be maintained at that height for the balance of the test.

715.5.2 Nonsymmetrical glazing systems. Nonsymmetrical fire-protection-rated glazing systems in fire partitions, fire barriers or in exterior walls with a fire separation distance of 5 feet (1524 mm) or less pursuant to Section 704 shall be tested with both faces exposed to the furnace, and the assigned fire protection rating shall be the shortest duration obtained from the two tests conducted in compliance with NFPA 257.

715.5.3 Wired glass. Steel window frame assemblies of 0.125-inch (3.2 mm) minimum solid section or of not less than nominal 0.048-inch-thick (1.2 mm) formed sheet steel members fabricated by pressing, mitering, riveting, interlocking or welding and having provision for glazing with 1/4-inch (6.4 mm) wired glass where securely installed in the building construction and glazed with 1/4-inch (6.4 mm) labeled wired glass shall be deemed to meet the requirements for a 3/4-hour fire window assembly. Wired glass panels shall conform to the size limitations set forth in Table 715.5.3.

715.5.4 Nonwired glass. Glazing other than wired glass in fire window assemblies shall be fire-protection-rated glazing installed in accordance with and complying with the size limitations set forth in NFPA 80.

715.5.5 Installation. Fire-protection-rated glazing shall be in the fixed position or be automatic-closing and shall be installed in approved frames.

715.5.6 Window mullions. Metal mullions that exceed a nominal height of 12 feet (3658 mm) shall be protected with materials to afford the same fire-resistance rating as required for the wall construction in which the protective is located.

715.5.7 Interior fire window assemblies. Fire-protection-rated glazing used in fire window assemblies located in fire partitions and fire barriers shall be limited to use in assemblies with a maximum fire-resistance rating of 1 hour in accordance with this section.

715.5.7.1 Where permitted. Fire-protection-rated glazing shall be limited to fire partitions designed in accordance with Section 708 and fire barriers utilized in the applications set forth in Sections 706.3.6 and 706.3.8 where the fire-resistance rating does not exceed 1 hour.

715.5.7.2 Size limitations. The total area of windows shall not exceed 25 percent of the area of a common wall with any room.

715.5.8 Labeling requirements. Fire-protection-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and information required in Section 715.5.8.1 that shall be issued by an approved agency and shall be permanently affixed to the glazing.

715.5.8.1 Identification. For fire-protection-rated glazing, the label shall bear the following two-part identification: "OH – XXX." "OH" indicates that the glazing meets both the fire-resistance and the hose-stream requirements of NFPA 257 and is permitted to be used in openings. "XXX" represents the fire-protection rating period, in minutes, that was tested.

SECTION 716
DUCTS AND AIR TRANSFER OPENINGS

716.1 General. The provisions of this section shall govern the protection of duct penetrations and air transfer openings in assemblies required to be protected.

716.1.1 Ducts without dampers. Ducts that penetrate fire-resistance-rated assemblies and are not required by this section to have dampers shall comply with the requirements of Section 712.

716.2 Installation. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers located within air distribution and smoke control systems shall be installed in accordance with the requirements of this section, the manufacturer's installation instructions and the dampers' listing.

716.2.1 Smoke control system. Where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized.

716.2.2 Hazardous exhaust ducts. Fire dampers for hazardous exhaust duct systems shall comply with the *Florida Building Code, Mechanical*.

716.3 Damper testing and ratings. Dampers shall be listed and bear the label of an approved testing agency indicating compliance with the standards in this section. Fire dampers shall comply with the requirements of UL 555. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire. Smoke dampers shall comply with the requirements of UL 555S. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and UL 555S. Ceiling radiation dampers shall comply with the requirements of UL 555C.

716.3.1 Fire protection rating. Fire dampers shall have the minimum fire protection rating specified in Table 716.3.1 for the type of penetration.

TABLE 716.3.1
FIRE DAMPER RATING

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hours)
Less than 3-hour fire-resistance-rated assemblies	1.5
3-hour or greater fire-resistance-rated assemblies	3

716.3.1.1 Fire damper actuating device. The fire damper actuating device shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (10°C) above the normal temperature within the duct system, but not less than 160°F (71°C).
2. The operating temperature shall be not more than 286°F (141°C) where located in a smoke control system complying with Section 909.
3. Where a combination fire/smoke damper is located in a smoke control system complying with Section 909, the operating temperature rating shall be approximately 50°F (10°C) above the maximum smoke control system designed operating temperature, or a maximum temperature of 350°F (177°C). The temperature shall not exceed the UL 555S degradation test temperature rating for a combination fire/smoke damper.

716.3.2 Smoke damper ratings. Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall not be less than 250°F (121°C).

716.3.2.1 Smoke damper actuation methods. The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with Section 907.10 and one of the following methods, as applicable:

1. Where a damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.
3. Where a damper is installed within an unducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5 feet (1524 mm) horizontally of the damper.
4. Where a damper is installed in a corridor wall or ceiling, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a total-coverage smoke detector system is provided within areas served by a heating, ventilation and air-conditioning (HVAC) system, dampers shall be permitted to be controlled by the smoke detection system.

716.4 Access and identification. Fire and smoke dampers shall be provided with an approved means of access, which is large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch (12.7 mm) in height reading: FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

716.5 Where required. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers shall be provided at the locations prescribed in Sections 716.5.1 through 716.5.5 and Section 716.6. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be required.

716.5.1 Fire walls. Ducts and air transfer openings permitted in fire walls in accordance with Section 705.11 shall be protected with listed fire dampers installed in accordance with their listing.

716.5.2 Fire barriers. Ducts and air transfer openings of fire barriers shall be protected with approved fire dampers installed in accordance with their listings. Ducts and air

transfer openings shall not penetrate exit enclosures and exit passageways except as permitted by Sections 1020.1.2 and 1021.5, respectively.

Exception: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E 119 as part of the fire-resistance-rated assembly.
2. Ducts are used as part of an approved smoke control system in accordance with Section 909 and where the use of a fire damper would interfere with the operation of a smoke control system.
3. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

716.5.3 Shaft enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with listed fire and smoke dampers installed in accordance with their listing.

Exceptions:

1. Fire dampers are not required at penetrations of shafts where:
   1.1. Steel exhaust subducts are extended at least 22 inches (559 mm) vertically in exhaust shafts, provided there is a continuous airflow upward to the outside; or
   1.2. Penetrations are tested in accordance with ASTM E 119 as part of the fire-resistance-rated assembly; or
   1.3. Ducts are used as part of an approved smoke control system in accordance with Section 909 and where the fire damper will interfere with the operation of the smoke control system; or
   1.4. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
2. In Group B and R occupancies, equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, smoke dampers are not required at penetrations of shafts where:
   2.1. Kitchen, clothes dryer, bathroom and toilet room exhaust openings are installed with steel exhaust subducts, having a wall thickness of at least 0.019 inch (0.48 mm); and
   2.2. That extend at least 22 inches (559 mm) vertically; and
   2.3. An exhaust fan is installed at the upper terminus of the shaft that is, powered continuously in accordance with the provisions of Section 909.11, so as to maintain a continuous upward airflow to the outside.
3. Smoke dampers are not required at penetration of exhaust or supply shafts in parking garages that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
4. Smoke dampers are not required at penetrations of shafts where ducts are used as part of an approved mechanical smoke control system designed in accordance with Section 909 and where the smoke damper will interfere with the operation of the smoke control system.

716.5.4 Fire partitions. Ducts and air transfer openings that penetrate fire partitions shall be protected with listed fire dampers installed in accordance with their listing.

Exceptions: In occupancies other than Group H, fire dampers are not required where:

1. The duct system is constructed of approved materials in accordance with the *Florida Building Code, Mechanical* and the duct penetrating the wall complies with all of the following requirements:
   1.1. The duct shall not exceed 100 square inches (0.06 m^2).
   1.2. The duct shall be constructed of steel a minimum of 0.0217 inch (0.55 mm) in thickness.
   1.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
   1.4. The duct shall be installed above a ceiling.
   1.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.
   1.6. A minimum 12-inch-long (305 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum $1^1/_2$-inch by $1^1/_2$-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The annular space between the steel sleeve and the wall opening shall be filled with mineral wool batting on all sides.
2. Tenant partitions in covered mall buildings where the walls are not required by provisions elsewhere in the code to extend to the underside of the floor roof deck above.

716.5.4.1 Corridors. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a corridor enclosure required to have smoke and draft control doors in accordance with Section 715.4.3.

Exceptions:

1. Smoke dampers are not required where the building is equipped throughout with an approved smoke control system in accordance with Section 909, and smoke dampers are not necessary for the operation and control of the system.
2. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness and there are no openings serving the corridor.

716.5.5 Smoke barriers. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier. Smoke dampers and smoke damper actuation methods shall comply with Section 716.3.2.1.

Exception: Smoke dampers are not required where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.

716.6 Horizontal assemblies. Penetrations by ducts and air transfer openings of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with Section 707 or shall comply with Sections 716.6.1 through 716.6.3.

716.6.1 Through penetrations. In occupancies other than Groups I-2 and I-3, a duct constructed of approved materials in accordance with the *Florida Building Code, Mechanical* that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection, provided a listed fire damper is installed at the floor line or the duct is protected in accordance with Section 712.4. For air transfer openings, see Exception 7 to Section 707.2.

Exception: A duct is permitted to penetrate three floors or less without a fire damper at each floor, provided it meets all of the following requirements:

1. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel not less than 0.019 inch (0.48 mm) (26 gage) in thickness.
2. The duct shall open into only one dwelling or sleeping unit and the duct system shall be continuous from the unit to the exterior of the building.
3. The duct shall not exceed 4-inch (102 mm) nominal diameter and the total area of such ducts shall not exceed 100 square inches (0.065 m^2) in any 100 square feet (9.3 m^2) of floor area.
4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time-temperature conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.
5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with a listed ceiling radiation damper installed in accordance with Section 716.6.2.1.

716.6.2 Membrane penetrations. Ducts and air transfer openings constructed of approved materials in accordance with the *Florida Building Code, Mechanical* that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with one of the following:

1. A shaft enclosure in accordance with Section 707.
2. A listed ceiling radiation damper installed at the ceiling line where a duct penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.
3. A listed ceiling radiation damper installed at the ceiling line where a diffuser with no duct attached penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.

716.6.2.1 Ceiling radiation dampers. Ceiling radiation dampers shall be tested in accordance with UL 555C and installed in accordance with the manufacturer's installation instructions and listing. Ceiling radiation dampers are not required where either of the following applies:

1. Tests in accordance with ASTM E 119 have shown that ceiling radiation dampers are not necessary in order to maintain the fire-resistance rating of the assembly.
2. Where exhaust duct penetrations are protected in accordance with Section 712.4.1.2, are located within the cavity of a wall and do not pass through another dwelling unit or tenant space.

716.6.3 Nonfire-resistance-rated floor assemblies. Duct systems constructed of approved materials in accordance with the *Florida Building Code, Mechanical* that penetrate nonfire-resistance-rated floor assemblies shall be protected by any of the following methods:

1. A shaft enclosure in accordance with Section 707.
2. The duct connects not more than two stories, the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion.
3. The duct connects not more than three stories, the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion and a fire damper is installed at each floor line.

Exception: Fire dampers are not required in ducts within individual residential dwelling units.

716.7 Flexible ducts and air connectors. Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly. Flexible air connectors shall not pass through any wall, floor or ceiling.

SECTION 717
CONCEALED SPACES

717.1 General. Fireblocking and draftstopping shall be installed in combustible concealed locations in accordance with this section. Fireblocking shall comply with Section 717.2. Draftstopping in floor/ceiling spaces and attic spaces shall comply with Sections 717.3 and 717.4, respectively. The permitted use of combustible materials in concealed spaces of buildings of Type I or II construction shall be limited to the applications indicated in Section 717.5.

717.2 Fireblocking. In combustible construction, fireblocking shall be installed to cut off concealed draft openings (both vertical and horizontal) and shall form an effective barrier between floors, between a top story and a roof or attic space. Fireblocking shall be installed in the locations specified in Sections 717.2.2 through 717.2.7.

717.2.1 Fireblocking materials. Fireblocking shall consist of 2-inch (51 mm) nominal lumber or two thicknesses of 1-inch (25 mm) nominal lumber with broken lap joints or one thickness of 0.719-inch (18.3 mm) wood structural panel with joints backed by 0.719-inch (18.3 mm) wood structural panel or one thickness of 0.75-inch (19 mm) particleboard with joints backed by 0.75-inch (19 mm) particleboard. Gypsum board, cement fiber board, batts or blankets of mineral wool, glass fiber or other approved materials installed in such a manner as to be securely retained in place shall be permitted as an acceptable fireblock. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be permitted for compliance with the 10-foot (3048 mm) horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases. The integrity of fireblocks shall be maintained.

717.2.1.1 Double stud walls. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be allowed as fireblocking in walls constructed using parallel rows of studs or staggered studs.

717.2.2 Concealed wall spaces. Fireblocking shall be provided in concealed spaces of stud walls and partitions, including furred spaces, and parallel rows of studs or staggered studs, as follows:

1. Vertically at the ceiling and floor levels.
2. Horizontally at intervals not exceeding 10 feet (3048 mm).

717.2.3 Connections between horizontal and vertical spaces. Fireblocking shall be provided at interconnections between concealed vertical stud wall or partition spaces and concealed horizontal spaces created by an assembly of floor joists or trusses, and between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and similar locations.

717.2.4 Stairways. Fireblocking shall be provided in concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall also comply with Section 1009.5.3.

717.2.5 Ceiling and floor openings. Where annular space protection is provided in accordance with Exception 6 of Section 707.2, Exception 1 of Section 712.4.1.2, or Section 712.4.2, fireblocking shall be installed at openings around vents, pipes, ducts, chimneys and fireplaces at ceiling and floor levels, with an approved material to resist the free passage of flame and the products of combustion. Factory-built chimneys and fireplaces shall be fireblocked in accordance with UL 103 and UL 127.

717.2.6 Architectural trim. Fireblocking shall be installed within concealed spaces of exterior wall finish and other exterior architectural elements where permitted to be of combustible construction as specified in Section 1406 or where erected with combustible frames, at maximum intervals of 20 feet (6096 mm), so that there will be no open space exceeding 100 square feet (9.3 m^3). Where wood furring strips are used, they shall be of approved wood of natural decay resistance or preservative-treated wood. If noncontinuous, such elements shall have closed ends, with at least 4 inches (102 mm) of separation between sections.

Exceptions:

1. Fireblocking of cornices is not required in single-family dwellings. Fireblocking of cornices of a two-family dwelling is required only at the line of dwelling unit separation.
2. Fireblocking shall not be required where installed on noncombustible framing and the face of the exterior wall finish exposed to the concealed space is covered by one of the following materials:
   2.1. Aluminum having a minimum thickness of 0.019 inch (0.5 mm).
   2.2. Corrosion-resistant steel having a base metal thickness not less than 0.016 inch (0.4 mm) at any point.
   2.3. Other approved noncombustible materials.

717.2.7 Concealed sleeper spaces. Where wood sleepers are used for laying wood flooring on masonry or concrete fire-resistance-rated floors, the space between the floor slab and the underside of the wood flooring shall be filled with an approved material to resist the free passage of flame and products of combustion or fireblocked in such a manner that there will be no open spaces under the flooring that will exceed 100 square feet (9.3 m^2) in area and such space shall be filled solidly under permanent partitions so that there is no communication under the flooring between adjoining rooms.

Exceptions:

1. Fireblocking is not required for slab-on-grade floors in gymnasiums.
2. Fireblocking is required only at the juncture of each alternate lane and at the ends of each lane in a bowling facility.

717.3 Draftstopping in floors. In combustible construction, draftstopping shall be installed to subdivide floor/ceiling assemblies in the locations prescribed in Sections 717.3.2 through 717.3.3.

717.3.1 Draftstopping materials. Draftstopping materials shall not be less than 0.5-inch (12.7 mm) gypsum board, 0.375-inch (9.5 mm) wood structural panel, 0.375-inch (9.5 mm) particleboard, 1-inch (25-mm) nominal lumber, cement fiberboard, batts or blankets of mineral wool or glass fiber, or other approved materials adequately supported. The integrity of draftstops shall be maintained.

717.3.2 Groups R-1, R-2, R-3 and R-4. Draftstopping shall be provided in floor/ceiling spaces in Group R-1 buildings, in Group R-2 buildings with three or more dwelling units, in Group R-3 buildings with two dwelling units and in Group R-4 buildings. Draftstopping shall be located above and in line with the dwelling unit and sleeping unit separations.

Exceptions:

1. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.2, provided that automatic sprinklers are also installed in the combustible concealed spaces.

717.3.3 Other groups. In other groups, draftstopping shall be installed so that horizontal floor areas do not exceed 1,000 square feet (93 m^2).

Exception: Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

717.4 Draftstopping in attics. In combustible construction, draftstopping shall be installed to subdivide attic spaces and concealed roof spaces in the locations prescribed in Sections 717.4.2 and 717.4.3. Ventilation of concealed roof spaces shall be maintained in accordance with Section 1203.2.

717.4.1 Draftstopping materials. Materials utilized for draftstopping of attic spaces shall comply with Section 717.3.1.

717.4.1.1 Openings. Openings in the partitions shall be protected by self-closing doors with automatic latches constructed as required for the partitions.

717.4.2 Groups R-1 and R-2. Draftstopping shall be provided in attics, mansards, overhangs or other concealed roof spaces of Group R-2 buildings with three or more dwelling units and in all Group R-1 buildings. Draftstopping shall be installed above, and in line with, sleeping unit and dwelling unit separation walls that do not extend to the underside of the roof sheathing above.

Exceptions:

1. Where corridor walls provide a sleeping unit or dwelling unit separation, draftstopping shall only be required above one of the corridor walls.
2. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. In occupancies in Group R-2 that do not exceed four stories in height, the attic space shall be subdivided by draftstops into areas not exceeding 3,000 square feet (279 m^2) or above every two dwelling units, whichever is smaller.
4. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.2, provided that automatic sprinklers are also installed in the combustible concealed spaces.

717.4.3 Other groups. Draftstopping shall be installed in attics and concealed roof spaces, such that any horizontal area does not exceed 3,000 square feet (279 m^2).

Exception: Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

717.5 Combustible materials in concealed spaces in Type I or II construction. Combustible materials shall not be permitted in concealed spaces of buildings of Type I or II construction.

Exceptions:

1. Combustible materials in accordance with Section 603.
2. Combustible materials exposed within plenums complying with Section 602 of the *Florida Building Code, Mechanical.*
3. Class A interior finish materials classified in accordance with Section 803.
4. Combustible piping within partitions or shaft enclosures installed in accordance with the provisions of this code.
5. Combustible piping within concealed ceiling spaces installed in accordance with the *Florida Building Code, Mechanical* and the *Florida Building Code, Plumbing.*
6. Combustible insulation and covering on pipe and tubing, installed in concealed spaces other than plenums, complying with Section 719.7.

SECTION 718
FIRE-RESISTANCE REQUIREMENTS FOR PLASTER

718.1 Thickness of plaster. The minimum thickness of gypsum plaster or portland cement plaster used in a fire-resis-

tance-rated system shall be determined by the prescribed fire tests. The plaster thickness shall be measured from the face of the lath where applied to gypsum lath or metal lath.

718.2 Plaster equivalents. For fire-resistance purposes, 0.5 inch (12.7 mm) of unsanded gypsum plaster shall be deemed equivalent to 0.75 inch (19.1 mm) of one-to-three gypsum sand plaster or 1 inch (25 mm) of portland cement sand plaster.

718.3 Noncombustible furring. In buildings of Type I and II construction, plaster shall be applied directly on concrete or masonry or on approved noncombustible plastering base and furring.

718.4 Double reinforcement. Plaster protection more than 1 inch (25 mm) in thickness shall be reinforced with an additional layer of approved lath embedded at least 0.75 inch (19.1 mm) from the outer surface and fixed securely in place.

Exception: Solid plaster partitions or where otherwise determined by fire tests.

718.5 Plaster alternatives for concrete. In reinforced concrete construction, gypsum plaster or portland cement plaster is permitted to be substituted for 0.5 inch (12.7 mm) of the required poured concrete protection, except that a minimum thickness of 0.375 inch (9.5 mm) of poured concrete shall be provided in reinforced concrete floors and 1 inch (25 mm) in reinforced concrete columns in addition to the plaster finish. The concrete base shall be prepared in accordance with Section 2510.7.

SECTION 719
THERMAL- AND SOUND-INSULATING MATERIALS

719.1 General. Insulating materials, including facings such as vapor retarders and vapor-permeable membranes, similar coverings, and all layers of single and multilayer reflective foil insulations, shall comply with the requirements of this section. Where a flame spread index or a smoke-developed index is specified in this section, such index shall be determined in accordance with ASTM E 84. Any material that is subject to an increase in flame spread index or smoke-developed index beyond the limits herein established through the effects of age, moisture, or other atmospheric conditions shall not be permitted.

Exceptions:

1. Fiberboard insulation shall comply with Chapter 23.
2. Foam plastic insulation shall comply with Chapter 26.
3. Duct and pipe insulation and duct and pipe coverings and linings in plenums shall comply with the *Florida Building Code, Mechanical.*

719.2 Concealed installation. Insulating materials, where concealed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

Exception: Cellulose loose-fill insulation that is not spray applied, complying with the requirements of Section 719.6, shall only be required to meet the smoke-developed index of not more than 450.

719.2.1 Facings. Where such materials are installed in concealed spaces in buildings of Type III, IV or V construction, the flame spread and smoke-developed limitations do not apply to facings, coverings, and layers of reflective foil insulation that are installed behind and in substantial contact with the unexposed surface of the ceiling, wall or floor finish.

719.3 Exposed installation. Insulating materials, where exposed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

Exception: Cellulose loose-fill insulation that is not spray applied complying with the requirements of Section 719.6 shall only be required to meet the smoke-developed index of not more than 450.

719.3.1 Attic floors. Exposed insulation materials installed on attic floors shall have a critical radiant flux of not less than 0.12 watt per square centimeter when tested in accordance with ASTM E 970.

719.4 Loose-fill insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E 84 apparatus without a screen or artificial supports shall comply with the flame spread and smoke-developed limits of Sections 719.2 and 719.3 when tested in accordance with CAN/ULC S102.2.

Exception: Cellulose loose-fill insulation shall not be required to comply with the flame spread index requirement of CAN/ULC S102.2, provided such insulation complies with the requirements of Section 719.6.

719.5 Roof insulation. The use of combustible roof insulation not complying with Sections 719.2 and 719.3 shall be permitted in any type of construction provided it is covered with approved roof coverings directly applied thereto.

719.6 Cellulose loose-fill insulation. Cellulose loose-fill insulation shall comply with CPSC 16 CFR, Part 1209 and CPSC 16 CFR, Part 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR, Part 1209 and CPSC 16 CFR, Part 1404.

719.7 Insulation and covering on pipe and tubing. Insulation and covering on pipe and tubing shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

Exception: Insulation and covering on pipe and tubing installed in plenums shall comply with the *Florida Building Code, Mechanical.*

SECTION 720
PRESCRIPTIVE FIRE RESISTANCE

720.1 General. The provisions of this section contain prescriptive details of fire-resistance-rated building elements. The materials of construction listed in Tables 720.1(1), 720.1(2), and 720.1(3) shall be assumed to have the fire-resistance ratings prescribed therein. Where materials that change the capacity for heat dissipation are incorporated into a fire-resistance-rated assembly, fire test results or other substantiating data shall be made available to the building official to

show that the required fire-resistance-rating time period is not reduced.

720.1.1 Thickness of protective coverings. The thickness of fire-resistant materials required for protection of structural members shall be not less than set forth in Table 720.1(1), except as modified in this section. The figures shown shall be the net thickness of the protecting materials and shall not include any hollow space in back of the protection.

720.1.2 Unit masonry protection. Where required, metal ties shall be embedded in bed joints of unit masonry for protection of steel columns. Such ties shall be as set forth in Table 720.1(1) or be equivalent thereto.

720.1.3 Reinforcement for cast-in-place concrete column protection. Cast-in-place concrete protection for steel columns shall be reinforced at the edges of such members with wire ties of not less than 0.18 inch (4.6 mm) in diameter wound spirally around the columns on a pitch of not more than 8 inches (203 mm) or by equivalent reinforcement.

720.1.4 Plaster application. The finish coat is not required for plaster protective coatings where they comply with the design mix and thickness requirements of Tables 720.1(1), 720.1(2) and 720.1(3).

720.1.5 Bonded prestressed concrete tendons. For members having a single tendon or more than one tendon installed with equal concrete cover measured from the nearest surface, the cover shall not be less than that set forth in Table 720.1(1). For members having multiple tendons installed with variable concrete cover, the average tendon cover shall not be less than that set forth in Table 720.1(1), provided:

1. The clearance from each tendon to the nearest exposed surface is used to determine the average cover.
2. In no case can the clear cover for individual tendons be less than one-half of that set forth in Table 720.1(1). A minimum cover of 0.75 inch (19.1 mm) for slabs and 1 inch (25 mm) for beams is required for any aggregate concrete.
3. For the purpose of establishing a fire-resistance rating, tendons having a clear covering less than that set forth in Table 720.1(1) shall not contribute more than 50 percent of the required ultimate moment capacity for members less than 350 square inches (0.226 m^2) in cross-sectional area and 65 percent for larger members. For structural design purposes, however, tendons having a reduced cover are assumed to be fully effective.

SECTION 721
CALCULATED FIRE RESISTANCE

721.1 General. The provisions of this section contain procedures by which the fire resistance of specific materials or combinations of materials is established by calculations. These procedures apply only to the information contained in this section and shall not be otherwise used. The calculated fire resistance of concrete, concrete masonry, and clay masonry assemblies shall be permitted in accordance with ACI 216.1/TMS 0216. The calculated fire resistance of steel assemblies shall be permitted in accordance with Chapter 5 of ASCE 29.

721.1.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

CERAMIC FIBER BLANKET. A mineral wool insulation material made of alumina-silica fibers and weighing 4 to 10 pounds per cubic foot (pcf) (64 to 160 kg/m^3).

CONCRETE, CARBONATE AGGREGATE. Concrete made with aggregates consisting mainly of calcium or magnesium carbonate, such as limestone or dolomite, and containing 40 percent or less quartz, chert, or flint.

CONCRETE, CELLULAR. A lightweight insulating concrete made by mixing a preformed foam with portland cement slurry and having a dry unit weight of approximately 30 pcf (480 kg/m^3).

CONCRETE, LIGHTWEIGHT AGGREGATE. Concrete made with aggregates of expanded clay, shale, slag or slate or sintered fly ash or any natural lightweight aggregate meeting ASTM C 330 and possessing equivalent fire-resistance properties and weighing 85 to 115 pcf (1360 to 1840 kg/m^3).

CONCRETE, PERLITE. A lightweight insulating concrete having a dry unit weight of approximately 30 pcf (480 kg/m^3) made with perlite concrete aggregate. Perlite aggregate is produced from a volcanic rock which, when heated, expands to form a glass-like material of cellular structure.

CONCRETE, SAND-LIGHTWEIGHT. Concrete made with a combination of expanded clay, shale, slag, slate, sintered fly ash, or any natural lightweight aggregate meeting ASTM C 330 and possessing equivalent fire-resistance properties and natural sand. Its unit weight is generally between 105 and 120 pcf (1680 and 1920 kg/m^3).

CONCRETE, SILICEOUS AGGREGATE. Concrete made with normal-weight aggregates consisting mainly of silica or compounds other than calcium or magnesium carbonate, which contains more than 40-percent quartz, chert, or flint.

CONCRETE, VERMICULITE. A lightweight insulating concrete made with vermiculite concrete aggregate which is laminated micaceous material produced by expanding the ore at high temperatures. When added to a portland cement slurry the resulting concrete has a dry unit weight of approximately 30 pcf (480 kg/m^3).

GLASS FIBERBOARD. Fibrous glass roof insulation consisting of inorganic glass fibers formed into rigid boards using a binder. The board has a top surface faced with asphalt and kraft reinforced with glass fiber.

MINERAL BOARD. A rigid felted thermal insulation board consisting of either felted mineral fiber or cellular beads of expanded aggregate formed into flat rectangular units.

TABLE 720.1(1)
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS[m]

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hour	3 hour	2 hour	1 hour
1. Steel columns and all of primary trusses	1-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 6″ × 6″ or greater (not including sandstone, granite and siliceous gravel).[a]	2 1/2	2	1 1/2	1
	1-1.2	Carbonate, lightweight and sand-lightweight aggregate concrete, members 8″ × 8″ or greater (not including sandstone, granite and siliceous gravel).[a]	2	1 1/2	1	1
	1-1.3	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12″ × 12″ or greater (not including sandstone, granite and siliceous gravel).[a]	1 1/2	1	1	1
	1-1.4	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 6″ × 6″ or greater.[a]	3	2	1 1/2	1
	1-1.5	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 8″ × 8″ or greater.[a]	2 1/2	2	1	1
	1-1.6	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 12″ × 12″ or greater.[a]	2	1	1	1
	1-.2.1	Clay or shale brick with brick and mortar fill.[a]	3 3/4	—	—	2 1/4
	1-3.1	4″ hollow clay tile in two 2″ layers; 1/2″ mortar between tile and column; 3/8″ metal mesh 0.046″ wire diameter in horizontal joints; tile fill.[a]	4	—	—	—
	1-3.2	2″ hollow clay tile; 3/4″ mortar between tile and column; 3/8″ metal mesh 0.046″ wire diameter in horizontal joints; limestone concrete fill;[a] plastered with 3/4″ gypsum plaster.	3	—	—	—
	1-3.3	2″ hollow clay tile with outside wire ties 0.08″ diameter at each course of tile or 3/8″ metal mesh 0.046″ diameter wire in horizontal joints; limestone or trap-rock concrete fill[a] extending 1″ outside column on all sides.	—	—	3	—
	1-3.4	2″ hollow clay tile with outside wire ties 0.08″ diameter at each course of tile with or without concrete fill; 3/4″ mortar between tile and column.	—	—	—	2
	1-4.1	Cement plaster over metal lath wire tied to 3/4″ cold-rolled vertical channels with 0.049″ (No. 18 B.W. gage) wire ties spaced 3″ to 6″ on center. Plaster mixed 1:2 1/2 by volume, cement to sand.	—	—	2 1/2[b]	7/8
	1-5.1	Vermiculite concrete, 1:4 mix by volume over paperbacked wire fabric lath wrapped directly around column with additional 2″ × 2″ 0.065″/0.065″ (No. 16/16 B.W. gage) wire fabric placed 3/4″ from outer concrete surface. Wire fabric tied with 0.049″ (No. 18 B.W. gage) wire spaced 6″ on center for inner layer and 2″ on center for outer layer.	2	—	—	—
	1-6.1	Perlite or vermiculite gypsum plaster over metal lath wrapped around column and furred 1 1/4″ from column flanges. Sheets lapped at ends and tied at 6″ intervals with 0.049″ (No. 18 B.W. gage) tie wire. Plaster pushed through to flanges.	1 1/2	1	—	—
	1-6.2	Perlite or vermiculite gypsum plaster over self-furring metal lath wrapped directly around column, lapped 1″ and tied at 6″ intervals with 0.049″ (No. 18 B.W. gage) wire.	1 3/4	1 3/8	1	—
	1-6.3	Perlite or vermiculite gypsum plaster on metal lath applied to 3/4″ cold-rolled channels spaced 24″ apart vertically and wrapped flatwise around column.	1 1/2	—	—	—
	1-6.4	Perlite or vermiculite gypsum plaster over two layers of 1/2″ plain full-length gypsum lath applied tight to column flanges. Lath wrapped with 1″ hexagonal mesh of No. 20 gage wire and tied with doubled 0.035″ diameter (No. 18 B.W. gage) wire ties spaced 23″ on center. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2 1/2 cubic feet of aggregate for the 3-hour system.	2 1/2	2	—	—

(continued)

TABLE 720.1(1)—continued
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS[m]

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hour	3 hour	2 hour	1 hour
1. Steel columns and all of primary trusses (continued)	1-6.5	Perlite or vermiculate gypsum plaster over one layer of 1/2" plain full-length gypsum lath applied tight to column flanges. Lath tied with doubled 0.049" (No. 18 B.W. gage) wire ties spaced 23" on center and scratch coat wrapped with 1" hexagonal mesh 0.035" (No. 20 B.W. gage) wire fabric. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2 1/2 cubic feet of aggregate.	—	2	—	—
	1-7.1	Multiple layers of 1/2" gypsum wallboard[c] adhesively[d] secured to column flanges and successive layers. Wallboard applied without horizontal joints. Corner edges of each layer staggered. Wallboard layer below outer layer secured to column with doubled 0.049" (No. 18 B.W. gage) steel wire ties spaced 15" on center. Exposed corners taped and treated.	—	—	2	1
	1-7.2	Three layers of 5/8" Type X gypsum wallboard.[c] First and second layer held in place by 1/8" diameter by 1 3/8" long ring shank nails with 5/16" diameter heads spaced 24" on center at corners. Middle layer also secured with metal straps at mid-height and 18" from each end, and by metal corner bead at each corner held by the metal straps. Third layer attached to corner bead with 1" long gypsum wallboard screws spaced 12" on center.	—	—	1 7/8	—
	1-7.3	Three layers of 5/8" Type X gypsum wallboard,[c] each layer screw attached to 1 5/8" steel studs 0.018" thick (No. 25 carbon sheet steel gage) at each corner of column. Middle layer also secured with 0.049" (No. 18 B.W. gage) double-strand steel wire ties, 24" on center. Screws are No. 6 by 1" spaced 24" on center for inner layer, No. 6 by 1 5/8" spaced 12" on center for middle layer and No. 8 by 2 1/4" spaced 12" on center for outer layer.	—	1 7/8	—	—
	1-8.1	Wood-fibered gypsum plaster mixed 1:1 by weight gypsum-to-sand aggregate applied over metal lath. Lath lapped 1" and tied 6" on center at all end, edges and spacers with 0.049" (No. 18 B.W. gage) steel tie wires. Lath applied over 1/2" spacers made of 3/4" furring channel with 2" legs bent around each corner. Spacers located 1" from top and bottom of member and a maximum of 40" on center and wire tied with a single strand of 0.049" (No. 18 B.W. gage) steel tie wires. Corner bead tied to the lath at 6" on center along each corner to provide plaster thickness.	—	—	1 5/8	—
	1-9.1	Minimum W8x35 wide flange steel column (w/d ≥ 0.75) with each web cavity filled even with the flange tip with normal weight carbonate or siliceous aggregate concrete (3,000 psi minimum compressive strength with 145 pcf ± 3 pcf unit weight). Reinforce the concrete in each web cavity with a minimum No. 4 deformed reinforcing bar installed vertically and centered in the cavity, and secured to the column web with a minimum No. 2 horizontal deformed reinforcing bar welded to the web every 18" on center vertically. As an alternative to the No. 4 rebar, 3/4" diameter by 3" long headed studs, spaced at 12" on center vertically, shall be welded on each side of the web midway between the column flanges.	—	—	—	See Note n
2. Webs or flanges of steel beams and girders	2-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete (not including sandstone, granite and siliceous gravel) with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 0.025 square inch of steel area per foot in each direction.	2	1 1/2	1	1
	2-1.2	Siliceous aggregate concrete and concrete excluded in Item 2-1.1 with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 0.025 square inch of steel area per foot in each direction.	2 1/2	2	1 1/2	1
	2-2.1	Cement plaster on metal lath attached to 3/4" cold-rolled channels with 0.04" (No. 18 B.W. gage) wire ties spaced 3" to 6" on center. Plaster mixed 1:2 1/2 by volume, cement to sand.	—	—	2 1/2[b]	7/8

(continued)

TABLE 720.1(1)—continued
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS[m]

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hour	3 hour	2 hour	1 hour
2. Webs or flanges of steel beams and girders (continued)	2-3.1	Vermiculite gypsum plaster on a metal lath cage, wire tied to 0.165″ diameter (No. 8 B.W. gage) steel wire hangers wrapped around beam and spaced 16″ on center. Metal lath ties spaced approximately 5″ on center at cage sides and bottom.	—	7/8	—	—
	2-4.1	Two layers of 5/8″ Type X gypsum wallboard[c] are attached to U-shaped brackets spaced 24″ on center. 0.018″ thick (No. 25 carbon sheet steel gage) 1 5/8″ deep by 1″ galvanized steel runner channels are first installed parallel to and on each side of the top beam flange to provide a 1/2″ clearance to the flange. The channel runners are attached to steel deck or concrete floor construction with approved fasteners spaced 12″ on center. U-shaped brackets are formed from members identical to the channel runners. At the bent portion of the U-shaped bracket, the flanges of the channel are cut out so that 1 5/8″ deep corner channels can be inserted without attachment parallel to each side of the lower flange. As an alternate, 0.021″ thick (No. 24 carbon sheet steel gage) 1″× 2″ runner and corner angles may be used in lieu of channels, and the web cutouts in the U-shaped brackets may be omitted. Each angle is attached to the bracket with 1/2″-long No. 8 self-drilling screws. The vertical legs of the U-shaped bracket are attached to the runners with one 1/2″ long No. 8 self-drilling screw. The completed steel framing provides a 2 1/8″ and 1 1/2″ space between the inner layer of wallboard and the sides and bottom of the steel beam, respectively. The inner layer of wallboard is attached to the top runners and bottom corner channels or corner angles with 1 1/4″-long No. 6 self-drilling screws spaced 16″ on center. The outer layer of wallboard is applied with 1 3/4″-long No. 6 self-drilling screws spaced 8″ on center. The bottom corners are reinforced with metal corner beads.	—	—	1 1/4	—
	2-4.2	Three layers of 5/8″ Type X gypsum wallboard[c] attached to a steel suspension system as described immediately above utilizing the 0.018″ thick (No. 25 carbon sheet steel gage) 1″ × 2″ lower corner angles. The framing is located so that a 2 1/8″ and 2″ space is provided between the inner layer of wallboard and the sides and bottom of the beam, respectively. The first two layers of wallboard are attached as described immediately above. A layer of 0.035″ thick (No. 20 B.W. gage) 1″ hexagonal galvanized wire mesh is applied under the soffit of the middle layer and up the sides approximately 2″. The mesh is held in position with the No. 6 1 5/8″-long screws installed in the vertical leg of the bottom corner angles. The outer layer of wallboard is attached with No. 6 2 1/4″-long screws spaced 8″ on center. One screw is also installed at the mid-depth of the bracket in each layer. Bottom corners are finished as described above.	—	1 7/8	—	—
3. Bonded pretensioned reinforcement in prestressed concrete[e]	3-1.1	Carbonate, lightweight, sand-lightweight and siliceous[f] aggregate concrete Beams or girders Solid slabs[h]	4[g]	3[g] 2	2 1/2 1 1/2	1 1/2 1
4. Bonded or unbonded post-tensioned tendons in prestressed concrete[e, i]	4-1.1	Carbonate, lightweight, sand-lightweight and siliceous[f] aggregate concrete Unrestrained members: Solid slabs[h] Beams and girders[j] 8″ wide greater than 12″ wide	— 3	2 4 1/2 2 1/2	1 1/2 2 1/2 2	— 1 3/4 1 1/2
	4-1.2	Carbonate, lightweight, sand-lightweight and siliceous aggregate Restrained members:[k] Solid slabs[h] Beams and girders[j] 8″ wide greater than 12″ wide	1 1/4 2 1/2 2	1 2 1 3/4	3/4 1 3/4 1 1/2	— — —

(continued)

TABLE 720.1(1)—continued
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS[m]

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hour	3 hour	2 hour	1 hour
5. Reinforcing steel in reinforced concrete columns, beams girders and trusses	5-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12″ or larger, square or round. (Size limit does not apply to beams and girders monolithic with floors.)	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
		Siliceous aggregate concrete, members 12″ or larger, square or round. (Size limit does not apply to beams and girders monolithic with floors.)	2	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
6. Reinforcing steel in reinforced concrete joists[l]	6-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete.	$1\frac{1}{4}$	$1\frac{1}{4}$	1	$\frac{3}{4}$
	6-1.2	Siliceous aggregate concrete.	$1\frac{3}{4}$	$1\frac{1}{2}$	1	$\frac{3}{4}$
7. Reinforcing and tie rods in floor and roof slabs[l]	7-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete.	1	1	$\frac{3}{4}$	$\frac{3}{4}$
	7-1.2	Siliceous aggregate concrete.	$1\frac{1}{4}$	1	1	$\frac{3}{4}$

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm^2, 1 cubic foot = 0.0283 m^3.

a. Reentrant parts of protected members to be filled solidly.

b. Two layers of equal thickness with a $\frac{3}{4}$-inch airspace between.

c. For all of the construction with gypsum wallboard described in Table 720.1(1), gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard and the joints on the face layer are reinforced, and the entire surface is covered with a minimum of $\frac{1}{16}$-inch gypsum veneer plaster.

d. An approved adhesive qualified under ASTM E 119.

e. Where lightweight or sand-lightweight concrete having an oven-dry weight of 110 pounds per cubic foot or less is used, the tabulated minimum cover shall be permitted to be reduced 25 percent, except that in no case shall the cover be less than $\frac{3}{4}$ inch in slabs or $1\frac{1}{2}$ inches in beams or girders.

f. For solid slabs of siliceous aggregate concrete, increase tendon cover 20 percent.

g. Adequate provisions against spalling shall be provided by U-shaped or hooped stirrups spaced not to exceed the depth of the member with a clear cover of 1 inch.

h. Prestressed slabs shall have a thickness not less than that required in Table 720.1(3) for the respective fire resistance time period.

i. Fire coverage and end anchorages shall be as follows: Cover to the prestressing steel at the anchor shall be $\frac{1}{2}$ inch greater than that required away from the anchor. Minimum cover to steel-bearing plate shall be 1 inch in beams and $\frac{3}{4}$ inch in slabs.

j. For beam widths between 8 inches and 12 inches, cover thickness shall be permitted to be determined by interpolation.

k. Interior spans of continuous slabs, beams and girders shall be permitted to be considered restrained.

l. For use with concrete slabs having a comparable fire endurance where members are framed into the structure in such a manner as to provide equivalent performance to that of monolithic concrete construction.

m. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in GA 600 shall be accepted as if herein listed.

n. No additional insulating material is required on the exposed outside face of the column flange to achieve a 1-hour fire-resistance rating.

TABLE 720.1(2)
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
1. Brick of clay or shale	1-1.1	Solid brick of clay or shale[c]	6	4.9	3.8	2.7
	1-1.2	Hollow brick, not filled.	5.0	4.3	3.4	2.3
	1-1.3	Hollow brick unit wall, grout or filled with perlite vermiculite or expanded shale aggregate.	6.6	5.5	4.4	3.0
	1-2.1	4″ nominal thick units at least 75 percent solid backed with a hat-shaped metal furring channel $^3/_4$″ thick formed from 0.021″ sheet metal attached to the brick wall on 24″ centers with approved fasteners, and $^1/_2$″ Type X gypsum wallboard attached to the metal furring strips with 1″-long Type S screws spaced 8″ on center.	—	—	5[d]	—
2. Combination of clay brick and load-bearing hollow clay tile	2-1.1	4″ solid brick and 4″ tile (at least 40 percent solid).	—	8	—	—
	2-1.2	4″ solid brick and 8″ tile (at least 40 percent solid).	12	—	—	—
3. Concrete masonry units	3-1.1[f, g]	Expanded slag or pumice.	4.7	4.0	3.2	2.1
	3-1.2[f, g]	Expanded clay, shale or slate.	5.1	4.4	3.6	2.6
	3-1.3[f]	Limestone, cinders or air-cooled slag.	5.9	5.0	4.0	2.7
	3-1.4[f, g]	Calcareous or siliceous gravel.	6.2	5.3	4.2	2.8
4. Solid concrete[h, i]	4-1.1	Siliceous aggregate concrete.	7.0	6.2	5.0	3.5
		Carbonate aggregate concrete.	6.6	5.7	4.6	3.2
		Sand-lightweight concrete.	5.4	4.6	3.8	2.7
		Lightweight concrete.	5.1	4.4	3.6	2.5
5. Glazed or unglazed facing tile, nonload-bearing	5-1.1	One 2″ unit cored 15 percent maximum and one 4″ unit cored 25 percent maximum with $^3/_4$″ mortar-filled collar joint. Unit positions reversed in alternate courses.	—	$6^3/_8$	—	—
	5-1.2	One 2″ unit cored 15 percent maximum and one 4″ unit cored 40 percent maximum with $^3/_4$″ mortar-filled collar joint. Unit positions side with $^3/_4$″ gypsum plaster. Two wythes tied together every fourth course with No. 22 gage corrugated metal ties.	—	$6^3/_4$	—	—
	5-1.3	One unit with three cells in wall thickness, cored 29 percent maximum.	—	—	6	—
	5-1.4	One 2″ unit cored 22 percent maximum and one 4″ unit cored 41 percent maximum with $^1/_4$″ mortar-filled collar joint. Two wythes tied together every third course with 0.030″ (No. 22 galvanized sheet steel gage) corrugated metal ties.	—	—	6	—
	5-1.5	One 4″ unit cored 25 percent maximum with $^3/_4$″ gypsum plaster on one side.	—	—	$4^3/_4$	—
	5-1.6	One 4″ unit with two cells in wall thickness, cored 22 percent maximum.	—	—	—	4
	5-1.7	One 4″ unit cored 30 percent maximum with $^3/_4$″ vermiculite gypsum plaster on one side.	—	—	$4^1/_2$	—
	5-1.8	One 4″ unit cored 39 percent maximum with $^3/_4$″ gypsum plaster on one side.	—	—	—	$4^1/_2$

(continued)

TABLE 720.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
6. Solid gypsum plaster	6-1.1	3/4" by 0.055" (No. 16 carbon sheet steel gage) vertical cold-rolled channels, 16" on center with 2.6-pound flat metal lath applied to one face and tied with 0.049" (No. 18 B.W. Gage) wire at 6" spacing. Gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2[d]
	6-1.2	3/4" by 0.05" (No. 16 carbon sheet steel gage) cold-rolled channels 16" on center with metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Perlite or vermiculite gypsum plaster each side. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2 1/2 cubic feet of aggregate for the 1-hour system.	—	—	2 1/2[d]	2[d]
	6-1.3	3/4" by 0.055" (No. 16 carbon sheet steel gage) vertical cold-rolled channels, 16" on center with 3/8" gypsum lath applied to one face and attached with sheet metal clips. Gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2[d]
	6-2.1	Studless with 1/2" full-length plain gypsum lath and gypsum plaster each side. Plaster mixed 1:1 for scratch coat and 1:2 for brown coat, by weight, gypsum to sand aggregate.	—	—	—	2[d]
	6-2.2	Studless with 1/2" full-length plain gypsum lath and perlite or vermiculite gypsum plaster each side.	—	—	2 1/2[d]	2[d]
	6-2.3	Studless partition with 3/8" rib metal lath installed vertically adjacent edges tied 6" on center with No. 18 gage wire ties, gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2[d]
7. Solid perlite and portland cement	7-1.1	Perlite mixed in the ratio of 3 cubic feet to 100 pounds of portland cement and machine applied to stud side of 1 1/2" mesh by 0.058-inch (No. 17 B.W. gage) paper-backed woven wire fabric lath wire-tied to 4"-deep steel trussed wire[j] studs 16" on center. Wire ties of 0.049" (No. 18 B.W. gage) galvanized steel wire 6" on center vertically.	—	—	3 1/8[d]	—
8. Solid neat wood fibered gypsum plaster	8-1.1	3/4" by 0.055-inch (No. 16 carbon sheet steel gage) cold-rolled channels, 12" on center with 2.5-pound flat metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Neat gypsum plaster applied each side.	—	—	2[d]	—
9. Solid wallboard partition	9-1.1	One full-length layer 1/2" Type X gypsum wallboard[e] laminated to each side of 1" full-length V-edge gypsum coreboard with approved laminating compound. Vertical joints of face layer and coreboard staggered at least 3".	—	—	2[d]	—
10. Hollow (studless) gypsum wallboard partition	10-1.1	One full-length layer of 5/8" Type X gypsum wallboard[e] attached to both sides of wood or metal top and bottom runners laminated to each side of 1" × 6" full-length gypsum coreboard ribs spaced 2" on center with approved laminating compound. Ribs centered at vertical joints of face plies and joints staggered 24" in opposing faces. Ribs may be recessed 6" from the top and bottom.	—	—	—	2 1/4[d]
	10-1.2	1" regular gypsum V-edge full-length backing board attached to both sides of wood or metal top and bottom runners with nails or 1 5/8" drywall screws at 24" on center. Minimum width of rumors 1 5/8". Face layer of 1/2" regular full-length gypsum wallboard laminated to outer faces of backing board with approved laminating compound.	—	—	4 5/8[d]	—

(continued)

TABLE 720.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
11. Noncombustible studs—interior partition with plaster each side	11-1.1	$3^1/_4$" × 0.044" (No. 18 carbon sheet steel gage) steel studs spaced 24" on center. $^5/_8$" gypsum plaster on metal lath each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	$4^3/_4$[d]
	11-1.2	$3^3/_8$" × 0.055" (No. 16 carbon sheet steel gage) approved nailable[k] studs spaced 24" on center. $^5/_8$" neat gypsum wood-fibered plaster each side over $^3/_8$" rib metal lath nailed to studs with 6d common nails, 8" on center. Nails driven $1^1/_4$" and bent over.	—	—	$5^5/_8$	—
	11-1.3	4" × 0.044" (No. 18 carbon sheet steel gage) channel-shaped steel studs at 16" on center. On each side approved resilient clips pressed onto stud flange at 16" vertical spacing, $^1/_4$" pencil rods snapped into or wire tied onto outer loop of clips, metal lath wire-tied to pencil rods at 6" intervals, 1" perlite gypsum plaster, each side.	—	$7^5/_8$[d]	—	—
	11-1.4	$2^1/_2$" × 0.044" (No. 18 carbon sheet steel gage) steel studs spaced 16" on center. Wood fibered gypsum plaster mixed 1:1 by weight gypsum to sand aggregate applied on $^3/_4$-pound metal lath wire tied to studs, each side. $^3/_4$" plaster applied over each face, including finish coat.	—	—	$4^1/_4$[d]	—
12. Wood studs interior partition with plaster each side	12-1.1[l,m]	2" × 4" wood studs 16" on center with $^5/_8$" gypsum plaster on metal lath. Lath attached by 4d common nails bent over or No. 14 gage by $1^1/_4$" by $^3/_4$" crown width staples spaced 6" on center. Plaster mixed $1:1^1/_2$ for scratch coat and 1:3 for brown coat, by weight, gypsum to sand aggregate.	—	—	—	$5^1/_8$
	12-1.2[l]	2" × 4" wood studs 16" on center with metal lath and $^7/_8$" neat wood-fibered gypsum plaster each side. Lath attached by 6d common nails, 7" on center. Nails driven $1^1/_4$" and bent over.	—	—	$5^1/_2$[d]	—
	12-1.3[l]	2" × 4" wood studs 16" on center with $^3/_8$" perforated or plain gypsum lath and $^1/_2$" gypsum plaster each side. Lath nailed with $1^1/_8$" by No. 13 gage by $^{19}/_{64}$" head plasterboard blued nails, 4" on center. Plaster mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	$5^1/_4$
	12-1.4[l]	2" × 4" wood studs 16" on center with $^3/_8$" Type X gypsum lath and $^1/_2$" gypsum plaster each side. Lath nailed with $1^1/_8$" by No. 13 gage by $^{19}/_{64}$" head plasterboard blued nails, 5" on center. Plaster mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	$5^1/_4$
13.Noncombustible studs—interior partition with gypsum wallboard each side	13-1.1	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 24" on center with one full-length layer of $^5/_8$" Type X gypsum wallboard[e] applied vertically attached with 1" long No. 6 drywall screws to each stud. Screws are 8" on center around the perimeter and 12" on center on the intermediate stud. The wallboard may be applied horizontally when attached to $3^5/_8$" studs and the horizontal joints are staggered with those on the opposite side. Screws for the horizontal application shall be 8" on center at vertical edges and 12" on center at intermediate studs.	—	—	—	$2^7/_8$[d]
	13-1.2	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 25" on center with two full-length layers of $^1/_2$" Type X gypsum wallboard[e] applied vertically each side. First layer attached with 1"-long, No. 6 drywall screws, 8" on center around the perimeter and 12" on center on the intermediate stud. Second layer applied with vertical joints offset one stud space from first layer using $1^5/_8$" long, No. 6 drywall screws spaced 9" on center along vertical joints, 12" on center at intermediate studs and 24" on center along top and bottom runners.	—	—	$3^5/_8$[d]	—
	13-1.3	0.055" (No. 16 carbon sheet steel gage) approved nailable metal studs[e] 24" on center with full-length $^5/_8$" Type X gypsum wallboard[e] applied vertically and nailed 7" on center with 6d cement-coated common nails. Approved metal fastener grips used with nails at vertical butt joints along studs.	—	—	—	$4^7/_8$

(continued)

TABLE 720.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
14.Wood studs—interior partition with gypsum wallboard each side	14-1.1[h, m]	2″ × 4″ wood studs 16″ on center with two layers of $^3/_8$″ regular gypsum wallboard[e] each side, 4d cooler[n] or wallboard[n] nails at 8″ on center first layer, 5d cooler[n] or wallboard[n] nails at 8″ on center second layer with laminating compound between layers, joints staggered. First layer applied full length vertically, second layer applied horizontally or vertically	—	—	—	5
	14-1.2[l, m]	2″ × 4″ wood studs 16″ on center with two layers $^1/_2$″ regular gypsum wallboard[e] applied vertically or horizontally each side[k], joints staggered. Nail base layer with 5d cooler[n] or wallboard[n] nails at 8″ on center face layer with 8d cooler[n] or wallboard[n] nails at 8″ on center.	—	—	—	$5^1/_2$
	14-1.3[l, m]	2″ × 4″ wood studs 24″ on center with $^5/_8$″ Type X gypsum wallboard[e] applied vertically or horizontally nailed with 6d cooler[n] or wallboard[n] nails at 7″ on center with end joints on nailing members. Stagger joints each side.	—	—	—	$4^3/_4$
	14-1.4[l]	2″ × 4″ fire-retardant-treated wood studs spaced 24″ on center with one layer of $^5/_8$″ Type X gypsum wallboard[e] applied with face paper grain (long dimension) parallel to studs. Wallboard attached with 6d cooler[n] or wallboard[n] nails at 7″ on center.	—	—	—	$4^3/_4$[d]
	14-1.5[l, m]	2″ × 4″ wood studs 1″ on center with two layers $^5/_8$″ Type X gypsum wallboard[e] each side. Base layers applied vertically and nailed with 6d cooler[n] or wallboard[n] nails at 9″ on center. Face layer applied vertically or horizontally and nailed with 8d cooler[n] or wallboard[n] nails at 7″ on center. For nail-adhesive application, base layers are nailed 6″ on center. Face layers applied with coating of approved wallboard adhesive and nailed 12″ on center.	—	—	6	—
	14-1.6[l]	2″ × 3″ fire-retardant-treated wood studs spaced 24″ on center with one layer of $^5/_8$″ Type X gypsum wallboard[e] applied with face paper grain (long dimension) at right angles to studs. Wallboard attached with 6d cement-coated box nails spaced 7″ on center.	—	—	—	$3^5/_8$[d]
15. Exterior or interior walls	15-1.1[l, m]	Exterior surface with $^3/_4$″ drop siding over $^1/_2$″ gypsum sheathing on 2″ × 4″ wood studs at 16″ on center, interior surface treatment as required for 1-hour-rated exterior or interior 2″ × 4″ wood stud partitions. Gypsum sheathing nailed with $1^3/_4$″ by No. 11 gage by $^7/_{16}$″ head galvanized nails at 8″ on center. Siding nailed with 7d galvanized smooth box nails.	—	—	—	Varies
	15-1.2[l, m]	2″ × 4″ wood studs 16″ on center with metal lath and $^3/_4$″ cement plaster on each side. Lath attached with 6d common nails 7″ on center driven to 1″ minimum penetration and bent over. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	$5^3/_8$
	15-1.3[l, m]	2″ × 4″ wood studs 16″ on center with $^7/_8$″ cement plaster (measured from the face of studs) on the exterior surface with interior surface treatment as required for interior wood stud partitions in this table. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	Varies
	15-1.4	$3^5/_8$″ No. 16 gage noncombustible studs 16″ on center with $^7/_8$″ cement plaster (measured from the face of the studs) on the exterior surface with interior surface treatment as required for interior, nonbearing, noncombustible stud partitions in this table. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	Varies[d]

(continued)

TABLE 720.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
15. Exterior or interior walls (continued)	15-1.5[m]	$2^1/_4$" × $3^3/_4$" clay face brick with cored holes over $^1/_2$" gypsum sheathing on exterior surface of 2" × 4" wood studs at 16" on center and two layers $^5/_8$" Type X gypsum wallboard[e] on interior surface. Sheathing placed horizontally or vertically with vertical joints over studs nailed 6" on center with $1^3/_4$" × No. 11 gage by $^7/_{16}$" head galvanized nails. Inner layer of wallboard placed horizontally or vertically and nailed 8" on center with 6d cooler[n] or wallboard[n] nails. Outer layer of wallboard placed horizontally or vertically and nailed 8" on center with 8d cooler[n] or wallboard[n] nails. All joints staggered with vertical joints over studs. Outer layer joints taped and finished with compound. Nail heads covered with joint compound. 0.035 inch (No. 20 galvanized sheet gage) corrugated galvanized steel wall ties $^3/_4$" by $6^5/_8$" attached to each stud with two 8d cooler[n] or wallboard[n] nails every sixth course of bricks.	—	—	10	—
	15-1.6[l, m]	2" × 6" fire-retardant-treated wood studs 16" on center. Interior face has two layers of $^5/_8$" Type X gypsum with the base layer placed vertically and attached with 6d box nails 12" on center. The face layer is placed horizontally and attached with 8d box nails 8" on center at joints and 12" on center elsewhere. The exterior face has a base layer of $^5/_8$" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by self-furred exterior lath attached with $2^1/_2$", No. 12 gage galvanized roofing nails with a $^3/_8$" diameter head and spaced 6" on center along each stud. Cement plaster consisting of a $^1/_2$" brown coat is then applied. The scratch coat is mixed in the proportion of 1:3 by weight, cement to sand with 10 pounds of hydrated lime and 3 pounds of approved additives or admixtures per sack of cement. The brown coat is mixed in the proportion of 1:4 by weight, cement to sand with the same amounts of hydrated lime and approved additives or admixtures used in the scratch coat.	—	—	$8^1/_4$	—
	15-1.7[l, m]	2" × 6" wood studs 16" on center. The exterior face has a layer of $^5/_8$" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by 1" by No. 18 gage self-furred exterior lath attached with 8d by $2^1/_2$" long galvanized roofing nails spaced 6" on center along each stud. Cement plaster consisting of a $^1/_2$" scratch coat, a bonding agent and a $^1/_2$" brown coat and a finish coat is then applied. The scratch coat is mixed in the proportion of 1:3 by weight, cement to sand with 10 pounds of hydrated lime and 3 pounds of approved additives or admixtures per sack of cement. The brown coat is mixed in the proportion of 1:4 by weight, cement to sand with the same amounts of hydrated lime and approved additives or admixtures used in the scratch coat. The interior is covered with $^3/_8$" gypsum lath with 1" hexagonal mesh of 0.035 inch (No. 20 B.W. gage) woven wire lath furred out $^5/_{16}$" and 1" perlite or vermiculite gypsum plaster. Lath nailed with $1^1/_8$" by No. 13 gage by $^{19}/_{64}$" head plasterboard glued nails spaced 5" on center. Mesh attached by $1^3/_4$" by No. 12 gage by $^3/_8$" head nails with $^3/_8$" furrings, spaced 8" on center. The plaster mix shall not exceed 100 pounds of gypsum to $2^1/_2$ cubic feet of aggregate.	—	—	$8^3/_8$	—
	15-1.8[l, m]	2" × 6" wood studs 16" on center. The exterior face has a layer of $^5/_8$" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by $1^1/_2$" by No. 17 gage self-furred exterior lath attached with 8d by $2^1/_2$" long galvanized roofing nails spaced 6" on center along each stud. Cement plaster consisting of a $^1/_2$" scratch coat, and a $^1/_2$" brown coat is then applied. The plaster may be placed by machine. The scratch coat is mixed in the proportion of 1:4 by weight, plastic cement to sand. The brown coat is mixed in the proportion of 1:5 by weight, plastic cement to sand. The interior is covered with $^3/_8$" gypsum lath with 1" hexagonal mesh of No. 20 gage woven wire lath furred out $^5/_{16}$" and 1" perlite or vermiculite gypsum plaster. Lath nailed with $1^1/_8$" by No. 13 gage by $^{19}/_{64}$" head plasterboard glued nails spaced 5" on center. Mesh attached by $1^3/_4$" by No. 12 gage by $^3/_8$" head nails with $^3/_8$" furrings, spaced 8" on center. The plaster mix shall not exceed 100 pounds of gypsum to $2^1/_2$ cubic feet of aggregate.	—	—	$8^3/_8$	—

(continued)

TABLE 720.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
15. Exterior or interior walls (continued)	15-1.9	4″ No. 18 gage, nonload-bearing metal studs, 16″ on center, with 1″ portland cement lime plaster [measured from the back side of the 3/4-pound expanded metal lath] on the exterior surface. Interior surface to be covered with 1″ of gypsum plaster on 3/4-pound expanded metal lath proportioned by weight—1:2 for scratch coat, 1:3 for brown, gypsum to sand. Lath on one side of the partition fastened to 1/4″ diameter pencil rods supported by No. 20 gage metal clips, located 16″ on center vertically, on each stud. 3″ thick mineral fiber insulating batts friction fitted between the studs.	—	—	6 1/2[d]	—
	15-1.10	Steel studs 0.060″ thick, 4″ deep or 6″ at 16″ or 24″ centers, with 1/2″ Glass Fiber Reinforced Concrete (GFRC) on the exterior surface. GFRC is attached with flex anchors at 24″ on center, with 5″ leg welded to studs with two 1/2″-long flare-bevel welds, and 4″ foot attached to the GFRC skin with 5/8″ thick GFRC bonding pads that extend 2 1/2″ beyond the flex anchor foot on both sides. Interior surface to have two layers of 1/2″ Type X gypsum wallboard.[e] The first layer of wallboard to be attached with 1″-long Type S buglehead screws spaced 24″ on center and the second layer is attached with 1 5/8″-long Type S screws spaced at 12″ on center. Cavity is to be filled with 5″ of 4 pcf (nominal) mineral fiber batts. GFRC has 1 1/2″ returns packed with mineral fiber and caulked on the exterior.	—	—	6 1/2	—
	15-1.11	Steel studs 0.060″ thick, 4″ deep or 6″ at 16″ or 24″ centers, respectively, with 1/2″ Glass Fiber Reinforced Concrete (GFRC) on the exterior surface. GFRC is attached with flex anchors at 24″ on center, with 5″ leg welded to studs with two 1/2″-long flare-bevel welds, and 4″ foot attached to the GFRC skin with 5/8″-thick GFRC bonding pads that extend 2 1/2″ beyond the flex anchor foot on both sides. Interior surface to have one layer of 5/8″ Type X gypsum wallboard[e], attached with 1 1/4″-long Type S buglehead screws spaced 12″ on center. Cavity is to be filled with 5″ of 4 pcf (nominal) mineral fiber batts. GFRC has 1 1/2″ returns packed with mineral fiber and caulked on the exterior.	—	—	—	6 1/8
	15-1.12[q]	2″ × 6″ wood studs at 16″ with double top plates, single bottom plate; interior and exterior sides covered with 5/8″ Type X gypsum wallboard, 4′ wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4″ Type S drywall screws, spaced 12″ on center.	—	—	—	6 3/4
	15-1.13[q]	2″ × 6″ wood studs at 16″ with double top plates, single bottom plate; interior and exterior sides covered with 5/8″ Type X gypsum wallboard, 4′ wide, applied vertically with all joints over framing or blocking and fastened with 2 1/4″ Type S drywall screws, spaced 12″ on center. R-19 fiberglass insulation installed in stud cavity.	—	—	—	6 3/4
	15-1.14[q]	2″ × 6″ wood studs at 16″ with double top plates, single bottom plate; interior and exterior sides covered with 5/8″ Type X gypsum wallboard, 4′ wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4″ Type S drywall screws, spaced 7″ on center.	—	—	—	6 3/4
	15-1.15[q]	2″ × 4″ wood studs at 16″ with double top plates, single bottom plate; interior and exterior sides covered with 5/8″ Type X gypsum wallboard and sheathing, respectively, 4′ wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4″ Type S drywall screws, spaced 12″ on center. Cavity to be filled with 3 1/2″ mineral wool insulation.	—	—	—	4 3/4
	15-1.16[q]	2″ × 6″ wood studs at 24″ centers with double top plates, single bottom plate; interior and exterior side covered with two layers of 5/8″ Type X gypsum wallboard, 4′ wide, applied horizontally with vertical joints over studs. Base layer fastened with 2 1/4″ Type S drywall screws, spaced 8″ on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Cavity to be filled with 5 1/2″ mineral wool insulation.	—	—	—	4 1/2

(continued)

TABLE 720.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
16. Exterior walls rated for fire resistance from the inside only in accordance with Section 704.5.	16-1.1[q]	2″ × 4″ wood studs at 16″ centers with double top plates, single bottom plate; interior side covered with $^5/_8$″ Type X gypsum wallboard, 4′ wide, applied horizontally unblocked, and fastened with 2 $^1/_4$″ Type S drywall screws, spaced 12″ on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Exterior covered with $^3/_8$″ wood structural panels, applied vertically, horizontal joints blocked and fastened with 6d common nails (bright) — 12″ on center in the field, and 6″ on center panel edges. Cavity to be filled with 3 $^1/_2$″ mineral wool insulation. Rating established for exposure from interior side only.	—	—	—	4 $^1/_2$
	16-1.2[q]	2″ × 6″ (51mm x 152 mm) wood studs at 16 ″ centers with double top plates, single bottom plate; interior side covered with $^5/_8$″ Type X gypsum wallboard, 4′ wide, applied horizontally or vertically with vertical joints over studs and fastened with 2 $^1/_4$″ Type S drywall screws, spaced 12″ on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound, exterior side covered with $^7/_{16}$″ wood structural panels fastened with 6d common nails (bright) spaced 12″ on center in the field and 6″ on center along the panel edges. Cavity to be filled with 5 $^1/_2$″ mineral wool insulation. Rating established from the gypsum-covered side only.	—	—	—	6 $^9/_{16}$
	16-1.3	2″ × 6″ wood studs at 16″ centers with double top plates, single bottom plates; interior side covered with $^5/_8$″ Type X gypsum wallboard, 4′ wide, applied vertically with all joints over framing or blocking and fastened with 2 $^1/_4$″ Type S drywall screws spaced 7″ on center. Joints to be covered with tape and joint compound. Exterior covered with $^3/_8$″ wood structural panels (oriented strand board), applied vertically with edges over framing or blocking and fastened with 6d common nails (bright) at 12″ on center in the field and 6″ on center on panel edges. R-19 fiberglass insulation installed in stud cavity.	—	—	—	6 $^1/_2$

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm^2, 1 cubic foot = 0.0283 m^3.

a. Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.

b. Thickness shown for brick and clay tile is nominal thicknesses unless plastered, in which case thicknesses are net. Thickness shown for concrete masonry and clay masonry is equivalent thickness defined in Section 721.3.1 for concrete masonry and Section 721.4.1.1 for clay masonry. Where all cells are solid grouted or filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, the equivalent thickness shall be the thickness of the block or brick using specified dimensions as defined in Chapter 21. Equivalent thickness may also include the thickness of applied plaster and lath or gypsum wallboard, where specified.

c. For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is at least 75 percent of the gross cross-sectional area measured in the same plane.

d. Shall be used for nonbearing purposes only.

e. For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with a minimum of $^1/_{16}$-inch gypsum veneer plaster.

f. The fire-resistance time period for concrete masonry units meeting the equivalent thicknesses required for a 2-hour fire-resistance rating in Item 3, and having a thickness of not less than 7 $^5/_8$ inches is 4 hours when cores which are not grouted are filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, sand or slag having a maximum particle size of $^3/_8$ inch.

g. The fire-resistance rating of concrete masonry units composed of a combination of aggregate types or where plaster is applied directly to the concrete masonry shall be determined in accordance with ACI 216.1/TMS 0216. Lightweight aggregates shall have a maximum combined density of 65 pounds per cubic foot.

h. See also Note b. The equivalent thickness shall be permitted to include the thickness of cement plaster or 1.5 times the thickness of gypsum plaster applied in accordance with the requirements of Chapter 25.

i. Concrete walls shall be reinforced with horizontal and vertical temperature reinforcement as required by Chapter 19.

j. Studs are welded truss wire studs with 0.18 inch (No. 7 B.W. gage) flange wire and 0.18 inch (No. 7 B.W. gage) truss wires.

k. Nailable metal studs consist of two channel studs spot welded back to back with a crimped web forming a nailing groove.

l. Wood structural panels shall be permitted to be installed between the fire protection and the wood studs on either the interior or exterior side of the wood frame assemblies in this table, provided the length of the fasteners used to attach the fire protection is increased by an amount at least equal to the thickness of the wood structural panel.

m. The design stress of studs shall be reduced to 78 percent of allowable F'_c with the maximum not greater than 78 percent of the calculated stress with studs having a slenderness ratio l_e/d of 33.

n. For properties of cooler or wallboard nails, see ASTM C 514, ASTM C 547 or ASTM F 1667.

o. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in the GA 600 shall be accepted as if herein listed.

p. NCMA TEK 5-8A shall be permitted for the design of fire walls.

q. The design stress of studs shall be equal to a maximum of 100 percent of the allowable F'_c calculated in accordance with Section 2306.

TABLE 720.1(3)
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
1. Siliceous aggregate concrete	1-1.1	Slab (no ceiling required). Minimum cover over nonprestressed reinforcement shall not be less than $^3/_4$"[b].	7.0	6.2	5.0	3.5	—	—	—	—
2. Carbonate aggregate concrete	2-1.1		6.6	5.7	4.6	3.2	—	—	—	—
3. Sand-lightweight concrete	3-1.1		5.4	4.6	3.8	2.7	—	—	—	—
4. Lightweight concrete	4-1.1		5.1	4.4	3.6	2.5	—	—	—	—
5. Reinforced concrete	5-1.1	Slab with suspended ceiling of vermiculite gypsum plaster over metal lath attached to $^3/_4$" cold-rolled channels spaced 12" on center. Ceiling located 6" minimum below joists.	3	2	—	—	1	$^3/_4$	—	—
	5-2.1	$^3/_8$" Type X gypsum wallboard[c] attached to 0.018 inch (No. 25 carbon sheet steel gage) by $^7/_8$" deep by $2^5/_8$" hat-shaped galvanized steel channels with 1"-long No. 6 screws. The channels are spaced 24" on center, span 35" and are supported along their length at 35" intervals by 0.033" (No. 21 galvanized sheet gage) galvanized steel flat strap hangers having formed edges that engage the lips of the channel. The strap hangers are attached to the side of the concrete joists with $^5/_{32}$" by $1^1/_4$" long power-driven fasteners. The wallboard is installed with the long dimension perpendicular to the channels. All end joints occur on channels and supplementary channels are installed parallel to the main channels, 12" each side, at end joint occurrences. The finished ceiling is located approximately 12" below the soffit of the floor slab.	—	—	$2^1/_2$	—	—	—	$^5/_8$	—
6. Steel joists constructed with a poured reinforced concrete slab on metal lath forms or steel form units[d, e]	6-1.1	Gypsum plaster on metal lath attached to the bottom cord with single No. 16 gage or doubled No. 18 gage wire ties spaced 6" on center. Plaster mixed 1:2 for scratch coat, 1:3 for brown coat, by weight, gypsum-to-sand aggregate for 2-hour system. For 3-hour system plaster is neat.	—	—	$2^1/_2$	$2^1/_4$	—	—	$^3/_4$	$^5/_8$
	6-2.1	Vermiculite gypsum plaster on metal lath attached to the bottom chord with single No.16 gage or doubled 0.049-inch (No. 18 B.W. gage) wire ties 6" on center.	—	2	—	—	—	$^5/_8$	—	—
	6-3.1	Cement plaster over metal lath attached to the bottom chord of joists with single No. 16 gage or doubled 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. Plaster mixed 1:2 for scratch coat, 1:3 for brown coat for 1-hour system and 1:1 for scratch coat, 1:1 $^1/_2$ for brown coat for 2-hour system, by weight, cement to sand.	—	—	—	2	—	—	—	$^5/_8$[f]
	6-4.1	Ceiling of $^5/_8$" Type X wallboard[c] attached to $^7/_8$" deep by $2^5/_8$" by 0.021 inch (No. 25 carbon sheet steel gage) hat-shaped furring channels 12" on center with 1" long No. 6 wallboard screws at 8" on center. Channels wire tied to bottom chord of joists with doubled 0.049 inch (No. 18 B.W. gage) wire or suspended below joists on wire hangers.[g]	—	—	$2^1/_2$	—	—	—	$^5/_8$	—
	6-5.1	Wood-fibered gypsum plaster mixed 1:1 by weight gypsum to sand aggregate applied over metal lath. Lath tied 6" on center to $^3/_4$" channels spaced $13^1/_2$" on center. Channels secured to joists at each intersection with two strands of 0.049 inch (No. 18 B.W. gage) galvanized wire.	—	—	$2^1/_2$	—	—	—	$^3/_4$	—

(continued)

TABLE 720.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
7. Reinforced concrete slabs and joists with hollow clay tile fillers laid end to end in rows $2^1/_2$" or more apart; reinforcement placed between rows and concrete cast around and over tile.	7-1.1	$^5/_8$" gypsum plaster on bottom of floor or roof construction.	—	—	8[h]	—	—	—	$^5/_8$	—
	7-1.2	None	—	—	—	$5^1/_2$[i]	—	—	—	—
8. Steel joists constructed with a reinforced concrete slab on top poured on a $^1/_2$" deep steel deck.[e]	8-1.1	Vermiculite gypsum plaster on metal lath attached to $^3/_4$" cold-rolled channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center.	$2^1/_2$[j]	—	—	—	$^3/_4$	—	—	—
9. 3" deep cellular steel deck with concrete slab on top. Slab thickness measured to top.	9-1.1	Suspended ceiling of vermiculite gypsum plaster base coat and vermiculite acoustical plaster on metal lath attached at 6" intervals to $^3/_4$" cold-rolled channels spaced 12" on center and secured to $1^1/_2$" cold-rolled channels spaced 36" on center with 0.065" (No. 16 B.W. gage) wire. $1^1/_2$" channels supported by No. 8 gage wire hangers at 36" on center. Beams within envelope and with a $2^1/_2$" airspace between beam soffit and lath have a 4-hour rating.	$2^1/_2$	—	—	—	$1^1/_8$[k]	—	—	—
10. $1^1/_2$"-deep steel roof deck on steel framing. Insulation board, 30 pcf density, composed of wood fibers with cement binders of thickness shown bonded to deck with unified asphalt adhesive. Covered with a Class A or B roof covering.	10-1.1	Ceiling of gypsum plaster on metal lath. Lath attached to $^3/_4$" furring channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. $^3/_4$" channel saddle tied to 2" channels with doubled 0.065" (No. 16 B.W. gage) wire ties. 2" channels spaced 36" on center suspended 2" below steel framing and saddle-tied with 0.165" (No. 8 B.W. gage) wire. Plaster mixed 1:2 by weight, gypsum-to-sand aggregate.	—	—	$1^7/_8$	1	—	—	$^3/_4$[l]	$^3/_4$[l]
11. $1^1/_2$"-deep steel roof deck on steel-framing wood fiber insulation board, 17.5 pcf density on top applied over a 15-lb asphalt-saturated felt. Class A or B roof covering.	11-1.1	Ceiling of gypsum plaster on metal lath. Lath attached to $^3/_4$" furring channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. $^3/_4$" channels saddle tied to 2" channels with doubled 0.065" (No. 16 B.W. gage) wire ties. 2" channels spaced 36" on center suspended 2" below steel framing and saddle tied with 0.165" (No. 8 B.W. gage) wire. Plaster mixed 1:2 for scratch coat and 1:3 for brown coat, by weight, gypsum-to-sand aggregate for 1-hour system. For 2-hour system, plaster mix is 1:2 by weight, gypsum-to-sand aggregate.	—	—	$1^1/_2$	1	—	—	$^7/_8$[g]	$^3/_4$[l]

(continued)

TABLE 720.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
12. $1^1/_2$" deep steel roof deck on steel-framing insulation of rigid board consisting of expanded perlite and fibers impregnated with integral asphalt waterproofing; density 9 to 12 pcf secured to metal roof deck by $^1/_2$" wide ribbons of waterproof, cold-process liquid adhesive spaced 6" apart. Steel joist or light steel construction with metal roof deck, insulation, and Class A or B built-up roof covering.[e]	12-1.1	Gypsum-vermiculite plaster on metal lath wire tied at 6" intervals to $^3/_4$" furring channels spaced 12" on center and wire tied to 2" runner channels spaced 32" on center. Runners wire tied to bottom chord of steel joists.	—	—	1	—	—	—	$^7/_8$	—
13. Double wood floor over wood joists spaced 16" on center.[m,n]	13-1.1	Gypsum plaster over $^3/_8$" Type X gypsum lath. Lath initially applied with not less than four $1^1/_8$" by No. 13 gage by $^{19}/_{64}$" head plasterboard blued nails per bearing. Continuous stripping over lath along all joist lines. Stripping consists of 3" wide strips of metal lath attached by $1^1/_2$" by No. 11 gage by $^1/_2$" head roofing nails spaced 6" on center. Alternate stripping consists of 3" wide 0.049" diameter wire stripping weighing 1 pound per square yard and attached by No.16 gage by $1^1/_2$" by $^3/_4$" crown width staples, spaced 4" on center. Where alternate stripping is used, the lath nailing may consist of two nails at each end and one nail at each intermediate bearing. Plaster mixed 1:2 by weight, gypsum-to-sand aggregate.	—	—	—	—	—	—	—	$^7/_8$
	13-1.2	Cement or gypsum plaster on metal lath. Lath fastened with $1^1/_2$" by No. 11 gage by $^7/_{16}$" head barbed shank roofing nails spaced 5" on center. Plaster mixed 1:2 for scratch coat and 1:3 for brown coat, by weight, cement to sand aggregate.	—	—	—	—	—	—	—	$^5/_8$
	13-1.3	Perlite or vermiculite gypsum plaster on metal lath secured to joists with $1^1/_2$" by No. 11 gage by $^7/_{16}$" head barbed shank roofing nails spaced 5" on center.	—	—	—	—	—	—	—	$^5/_8$
	13-1.4	$^1/_2$" Type X gypsum wallboard[c] nailed to joists with 5d cooler[o] or wallboard[o] nails at 6" on center. End joints of wallboard centered on joists.	—	—	—	—	—	—	—	$^1/_2$
14. Plywood stressed skin panels consisting of $^5/_8$"-thick interior C-D (exterior glue) top stressed skin on 2" × 6" nominal (minimum) stringers. Adjacent panel edges joined with 8d common wire nails spaced 6" on center. Stringers spaced 12" maximum on center.	14-1.1	$^1/_2$"-thick wood fiberboard weighing 15 to 18 pounds per cubic foot installed with long dimension parallel to stringers or $^3/_8$" C-D (exterior glue) plywood glued and/or nailed to stringers. Nailing to be with 5d cooler[o] or wallboard[o] nails at 12" on center. Second layer of $^1/_2$" Type X gypsum wallboard[c] applied with long dimension perpendicular to joists and attached with 8d cooler[o] or wallboard[o] nails at 6" on center at end joints and 8" on center elsewhere. Wallboard joints staggered with respect to fiberboard joints.	—	—	—	—	—	—	—	1

(continued)

TABLE 720.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
15. Vermiculite concrete slab proportioned 1:4 (portland cement to vermiculite aggregate) on a $1^1/_2$"-deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10" where deck is less than 0.019 inch (No. 26 carbon steel sheet gage) or greater. Slab reinforced with 4" × 8" 0.109/0.083" (No. $^{12}/_{14}$ B.W. gage) welded wire mesh.	15-1.1	None	—	—	—	3[j]	—	—	—	—
16. Perlite concrete slab proportioned 1:6 (portland cement to perlite aggregate) on a $1^1/_4$"-deep steel deck supported on individually protected steel framing. Slab reinforced with 4" × 8" 0.109/0.083" (No. $^{12}/_{14}$ B.W. gage) welded wire mesh.	16-1.1	None	—	—	—	$3^1/_2$[j]	—	—	—	—
17. Perlite concrete slab proportioned 1:6 (portland cement to perlite aggregate) on a $^9/_{16}$"-deep steel deck supported by steel joists 4' on center. Class A or B roof covering on top.	17-1.1	Perlite gypsum plaster on metal lath wire tied to $^3/_4$" furring channels attached with 0.065" (No. 16 B.W. gage) wire ties to lower chord of joists.	—	2[p]	2[p]	—	—	$^7/_8$	$^3/_4$	—
18. Perlite concrete slab proportioned 1:6 (portland cement to perlite aggregate) on $1^1/_4$"-deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10" where deck is less than 0.019" (No. 26 carbon sheet steel gage) and 8'-0" where deck is 0.019" (No. 26 carbon sheet steel gage) or greater. Slab reinforced with 0.042" (No. 19 B.W. gage) hexagonal wire mesh. Class A or B roof covering on top.	18-1.1	None	—	$2^1/_4$[p]	$2^1/_4$[p]	—	—	—	—	—

(continued)

TABLE 720.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
19. Floor and beam construction consisting of 3″-deep cellular steel floor unit mounted on steel members with 1:4 (proportion of portland cement to perlite aggregate) perlite-concrete floor slab on top.	19-1.1	Suspended envelope ceiling of perlite gypsum plaster on metal lath attached to $^{3}/_{4}$″ cold-rolled channels, secured to $1^{1}/_{2}$″ cold-rolled channels spaced 42″ on center supported by 0.203 inch (No. 6 B.W. gage) wire 36″ on center. Beams in envelope with 3″ minimum airspace between beam soffit and lath have a 4-hour rating.	2[p]	—	—	—	1[l]	—	—	—
20. Perlite concrete proportioned 1:6 (portland cement to perlite aggregate) poured to $^{1}/_{8}$″ thickness above top of corrugations of $1^{5}/_{16}$″-deep galvanized steel deck maximum span 8′-0″ for 0.024″ (No. 24 galvanized sheet gage) or 6′ 0″ for 0.019″ (No. 26 galvanized sheet gage) with deck supported by individually protected steel framing. Approved polystyrene foam plastic insulation board having a flame spread not exceeding 75 (1″ to 4″ thickness) with vent holes that approximate 3 percent of the board surface area placed on top of perlite slurry. A 2′ by 4′ insulation board contains six $2^{3}/_{4}$″ diameter holes. Board covered with $2^{1}/_{4}$″ minimum perlite concrete slab.	20-1.1	None	—	—	Varies	—	—	—	—	—

(continued)

TABLE 720.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
(continued) 20. Slab reinforced with mesh consisting of 0.042″ (No. 19 B.W. gage) galvanized steel wire twisted together to form 2″ hexagons with straight 0.065″ (No. 16 B.W. gage) galvanized steel wire woven into mesh and spaced 3″. Alternate slab reinforcement shall be permitted to consist of 4″ × 8″, 0.109/0.238″ (No. 12/4 B.W. gage), or 2″ × 2″, 0.083/0.083″ (No. 14/14 B.W. gage) welded wire fabric. Class A or B roof covering on top.	20-1.1	None	—	—	Varies	—	—	—	—	—
21. Wood joists, wood I-joist, floor trusses and flat or pitched roof trusses spaced a maximum 24″ o.c. with $^1/_2$″ wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with 8d nails. The wood structural panel thickness shall not be less than nominal $^1/_2$″ less than required by Chapter 23.	21-1.1	Base layer $^5/_8$″ Type X gypsum wallboard applied at right angles to joist or truss 24″ o.c. with $1^1/_4$″ Type S or Type W drywall screws 24″ o.c. Face layer $^5/_8$″ Type X gypsum wallboard or veneer base applied at right angles to joist or truss through base layer with $1^7/_8$″ Type S or Type W drywall screws 12″ o.c. at joints and intermediate joist or truss. Face layer Type G drywall screws placed 2″ back on either side of face layer end joints, 12″ o.c.	—	—	—	Varies	—	—	—	$1^1/_4$
22. Steel joists, floor trusses and flat or pitched roof trusses spaced a maximum 24″ o.c. with $^1/_2$″ wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with No. 8 screws. The wood structural panel thickness shall not be less than nominal $^1/_2$″ less than required by Chapter 23.	22-1.1	Base layer $^5/_8$″ Type X gypsum board applied at right angles to steel framing 24″ on center with 1″ Type S drywall screws spaced 24″ on center. Face layer $^5/_8$″ Type X gypsum board applied at right angles to steel framing attached through base layer with $1^5/_8$″ Type S drywall screws 12″ on center at end joints and intermediate joints and $1^1/_2$″ Type G drywall screws 12 inches on center placed 2″ back on either side of face layer end joints. Joints of the face layer are offset 24″ from the joints of the base layer.	—	—	—	Varies	—	—	—	$1^1/_4$
23. Wood I-joist (minimum joist depth $9^1/_4$″ with a minimum flange depth of $1^5/_{16}$″ and a minimum flange cross- sectional area of 2.3 square inches) at 24″ o.c. spacing with 1 × 4 (nominal) wood furring strip spacer applied parallel to and covering the bottom of the bottom flange of each member, tacked in place. 2″ mineral wool insulation, 3.5 pcf (nominal) installed adjacent to the bottom flange of the I-joist and supported by the 1 × 4 furring strip spacer.	23-1.1	$^1/_2$″ deep single leg resilient channel 16″ on center (channels doubled at wallboard end joints), placed perpendicular to the furring strip and joist and attached to each joist by $1^7/_8$″ Type S drywall screws. $^5/_8$″ Type C gypsum wallboard applied perpendicular to the channel with end joints staggered at least 4′ and fastened with $1^1/_8$″ Type S drywall screws spaced 7″ on center. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	—

(continued)

TABLE 720.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
25. Wood I-joist (minimum I-joist depth $9^1/_4$" with a minimum flange depth of $1^1/_2$" and a minimum flange cross-sectional area of 5.25 square inches; minimum web thickness of $^3/_8$") @ 24" o.c., $1^1/_2$" mineral fiber insulation (2.5 pcf - nominal) resting on hat-shaped channels.	25-1.1	Minimum 0.026" thick hat-shaped channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by $1^5/_8$" Type S drywall screws. $^5/_8$" Type C gypsum wallboard applied perpendicular to the channel with end joints staggered and fastened with $1^1/_8$" Type S drywall screws spaced 12" o.c. in the field and 8" o.c. at the wallboard ends. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	Varies
26. Wood I-joist (minimum I-joist depth $9^1/_4$" with a minimum flange depth of $1^1/_2$" and a minimum flange cross-sectional area of 5.25 square inches; minimum web thickness of $^7/_{16}$") @ 24" o.c., $1^1/_2$" mineral fiber insulation (2.5 pcf - nominal) resting on resilient channels.	26-1.1	Minimum 0.019" thick resilient channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by $1^5/_8$" Type S drywall screws. $^5/_8$" Type C gypsum wallboard applied perpendicular to the channel with end joints staggered and fastened with 1" Type S drywall screws spaced 12" o.c. in the field and 8" o.c. at the wallboard ends. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	Varies
27. Wood I-joist (minimum I-joist depth $9^1/_4$" with a minimum flange thickness of $1^1/_2$" and a minimum flange cross-sectional area of 2.25 square inches; minimum web thickness of $^3/_8$") @ 24" o.c.	27-1.1	Two layers of $^1/_2$" Type X gypsum wallboard applied with the long dimension perpendicular to the I-joists with end joints staggered. The base layer is fastened with $1^5/_8$" Type S drywall screws spaced 12" o.c. and the face layer is fastened with 2" Type S drywall screws spaced 12" o.c. in the field and 8" o.c. on the edges. Face layer end joints shall not occur on the same I-joist as base layer end joints and edge joints shall be offset 24" from base layer joints. Face layer to also be attached to base layer with $1^1/_2$" Type G drywall screws spaced 8" o.c. placed 6" from face layer end joints. Face layer wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	Varies
28. Wood I-joist (minimum I-joist depth $9^1/_2$" with a minimum flange depth of $1^5/_{16}$" and a minimum flange cross-sectional area of 1.95 square inches; minimum web thickness of $^3/_8$") @ 24" o.c.	28-1.1	Minimum 0.019" thick resilient channel 16" o.c.(channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by $1^5/_8$" Type S drywall screws. Two layers of $^1/_2$" Type X gypsum wallboard applied with the long dimension perpendicular to the I-joists with end joints staggered. The base layer is fastened with $1^1/_4$" Type S drywall screws spaced 12" o.c. and the face layer is fastened with $1^5/_8$" Type S drywall screws spaced 12" o.c. Face layer end joints shall not occur on the same I-Joist as base layer end joints and edge joints shall be offset 24" from base layer joints. Face layer to also be attached to base layer with $1^1/_2$" Type G drywall screws spaced 8" o.c. placed 6" from face layer end joints. Face layer wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	Varies

(continued)

TABLE 720.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
29. Wood I-joist (minimum I-joist depth $9^1/_4$" with a minimum flange depth of $1^1/_2$" and a minimum flange cross-sectional area of 2.25 square inches; minimum web thickness of $^3/_8$") @ 24" o.c., with hat-shaped channels supporting the middle and face layers of gypsum wallboard. Unfaced fiberglass insulation is installed between the I-joists supported on the upper surface of the flange by stay wires spaced 12" o.c.	29-1.1	Base layer of $^5/_8$" Type C gypsum wallboard attached directly to I-joists with $1^5/_8$" Type S drywall screws spaced 12" o.c. with ends staggered. Minimum 0.0179" thick resilient channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by $1^5/_8$" Type S drywall screws after the base layer of gypsum wall board has been applied. The middle and face layers of $^5/_8$" Type C gypsum wallboard applied perpendicular to the channel with end joints staggered. The middle layer is fastened with 1" Type S drywall screws spaced 12" o.c. The face layer is applied parallel to the middle layer but with the edge joints offset 24" from those of the middle layer and fastened with $1^5/_8$" Type S drywall screws 8" o.c. The joints shall be taped and covered with joint compound.	—	—	—	Varies	—	—	—	Varies
30. Channel-shaped 18 gauge steel joists (minimum depth 8") spaced a maximum 24" o.c. supporting tongue-and-groove wood structural panels (nominal minimum $^3/_4$" thick) applied perpendicular to framing members. Structural panels attached with $1^5/_8$" Type S-12 screws spaced 12" o.c.	30-1.1	Base layer $^5/_8$" Type X gypsum board applied perpendicular to bottom of framing members with $1^1/_8$" Type S-12 screws spaced 12" o.c. Second layer $^5/_8$" Type X gypsum board attached perpendicular to framing members with $1^5/_8$" Type S-12 screws spaced 12" o.c. Second layer joints offset 24" from base layer. Third layer $^5/_8$" Type X gypsum board attached perpendicular to framing members with $2^3/_8$" Type S-12 screws spaced 12" o.c. Third layer joints offset 12" from second layer joints. Hat-shaped rigid furring channels applied at right angles to framing members over third layer with two $2^3/_8$" Type S-12 screws at each framing member. Face layer $^5/_8$" Type X gypsum board applied at right angles to furring channels with $1^1/_8$" Type S screws spaced 12" o.c.	—	—	Varies	—	—	—	$3^3/_8$	—

Table 720.1(3) Notes.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 cubic foot = 0.0283 m^3, 1 pound per square inch = 6.895 kPa, 1 pound per lineal foot = 1.4882 kg/m.

a. Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.

b. When the slab is in an unrestrained condition, minimum reinforcement cover shall not be less than $1^5/_8$ inches for 4-hour (siliceous aggregate only); $1^1/_4$ inches for 4- and 3-hour; 1 inch for 2-hour (siliceous aggregate only); and $^3/_4$ inch for all other restrained and unrestrained conditions.

c. For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with a minimum of $^1/_{16}$-inch gypsum veneer plaster.

d. Slab thickness over steel joists measured at the joists for metal lath form and at the top of the form for steel form units.

e. (a) The maximum allowable stress level for H-Series joists shall not exceed 22,000 psi.
(b) The allowable stress for K-Series joists shall not exceed 26,000 psi, the nominal depth of such joist shall not be less than 10 inches and the nominal joist weight shall not be less than 5 pounds per lineal foot.

f. Cement plaster with 15 pounds of hydrated lime and 3 pounds of approved additives or admixtures per bag of cement.

g. Gypsum wallboard ceilings attached to steel framing shall be permitted to be suspended with $1^1/_2$-inch cold-formed carrying channels spaced 48 inches on center, which are suspended with No. 8 SWG galvanized wire hangers spaced 48 inches on center. Cross-furring channels are tied to the carrying channels with No. 18 SWG galvanized wire hangers spaced 48 inches on center. Cross-furring channels are tied to the carrying channels with No. 18 SWG galvanized wire (double strand) and spaced as required for direct attachment to the framing. This alternative is also applicable to those steel framing assemblies recognized under Note q.

h. Six-inch hollow clay tile with 2-inch concrete slab above.

i. Four-inch hollow clay tile with $1^1/_2$-inch concrete slab above.

j. Thickness measured to bottom of steel form units.

k. Five-eighths inch of vermiculite gypsum plaster plus $^1/_2$ inch of approved vermiculite acoustical plastic.

l. Furring channels spaced 12 inches on center.

m. Double wood floor shall be permitted to be either of the following:
(a) Subfloor of 1-inch nominal boarding, a layer of asbestos paper weighing not less than 14 pounds per 100 square feet and a layer of 1-inch nominal tongue-and-groove finished flooring; or
(b) Subfloor of 1-inch nominal tongue-and-groove boarding or $^{15}/_{32}$-inch wood structural panels with exterior glue and a layer of 1-inch nominal tongue-and-groove finished flooring or $^{19}/_{32}$-inch wood structural panel finish flooring or a layer of Type I Grade M-1 particleboard not less than $^5/_8$-inch thick.

n. The ceiling shall be permitted to be omitted over unusable space, and flooring shall be permitted to be omitted where unusable space occurs above.

o. For properties of cooler or wallboard nails, see ASTM C 514, ASTM C 547 or ASTM F 1667.

p. Thickness measured on top of steel deck unit.

q. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in the GA 600 shall be accepted as if herein listed.

721.2 Concrete assemblies. The provisions of this section contain procedures by which the fire-resistance ratings of concrete assemblies are established by calculations.

721.2.1 Concrete walls. Cast-in-place and precast concrete walls shall comply with Section 721.2.1.1. Multiwythe concrete walls shall comply with Section 721.2.1.2. Joints between precast panels shall comply with Section 721.2.1.3. Concrete walls with gypsum wallboard or plaster finish shall comply with Section 721.2.1.4.

721.2.1.1 Cast-in-place or precast walls. The minimum equivalent thicknesses of cast-in-place or precast concrete walls for fire-resistance ratings of 1 hour to 4 hours are shown in Table 721.2.1.1. For solid walls with flat vertical surfaces, the equivalent thickness is the same as the actual thickness. The values in Table 721.2.1.1 apply to plain, reinforced or prestressed concrete walls.

TABLE 721.2.1.1
MINIMUM EQUIVALENT THICKNESS OF CAST-IN-PLACE OR PRECAST CONCRETE WALLS, LOAD-BEARING OR NONLOAD-BEARING

CONCRETE TYPE	MINIMUM SLAB THICKNESS (inches) FOR FIRE-RESISTANCE RATING OF				
	1-hour	$1^1/_2$-hour	2-hour	3-hour	4-hour
Siliceous	3.5	4.3	5.0	6.2	7.0
Carbonate	3.2	4.0	4.6	5.7	6.6
Sand-Lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

For SI: 1 inch = 25.4 mm.

721.2.1.1.1 Hollow-core precast wall panels. For hollow-core precast concrete wall panels in which the cores are of constant cross section throughout the length, calculation of the equivalent thickness by dividing the net cross-sectional area (the gross cross

section minus the area of the cores) of the panel by its width shall be permitted.

721.2.1.1.2 Core spaces filled. Where all of the core spaces of hollow-core wall panels are filled with loose-fill material, such as expanded shale, clay, or slag, or vermiculite or perlite, the fire-resistance rating of the wall is the same as that of a solid wall of the same concrete type and of the same overall thickness.

721.2.1.1.3 Tapered cross sections. The thickness of panels with tapered cross sections shall be that determined at a distance $2t$ or 6 inches (152 mm), whichever is less, from the point of minimum thickness, where t is the minimum thickness.

721.2.1.1.4 Ribbed or undulating surfaces. The equivalent thickness of panels with ribbed or undulating surfaces shall be determined by one of the following expressions:

For $s \geq 4t$, the thickness to be used shall be t

For $s \leq 2t$, the thickness to be used shall be t_e

For $4t > s > 2t$, the thickness to be used shall be

$$t + \left(\frac{4t}{s} - 1\right)\left(t_e - t\right) \qquad \textbf{(Equation 7-3)}$$

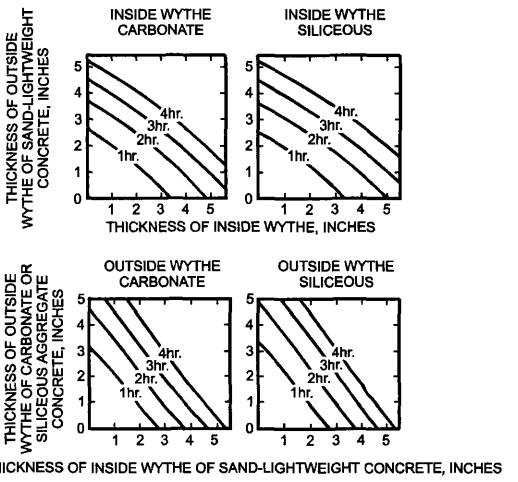
where:

s = Spacing of ribs or undulations.

t = Minimum thickness.

t_e = Equivalent thickness of the panel calculated as the net cross-sectional area of the panel divided by the width, in which the maximum thickness used in the calculation shall not exceed $2t$.

721.2.1.2 Multiwythe walls. For walls that consist of two wythes of different types of concrete, the fire-resistance ratings shall be permitted to be determined from Figure 721.2.1.2.



For SI: 1 inch = 25.4 mm.

FIGURE 721.2.1.2
FIRE-RESISTANCE RATINGS OF TWO-WYTHE CONCRETE WALLS

721.2.1.2.1 Two or more wythes. The fire-resistance rating for wall panels consisting of two or more wythes shall be permitted to be determined by the formula:

$$R = (R_1^{0.59} + R_2^{0.59} + \ldots + R_n^{0.59})^{1.7} \qquad \textbf{(Equation 7-4)}$$

where:

R = The fire endurance of the assembly, minutes.

R_1, R_2, and R_n = The fire endurances of the individual wythes, minutes. Values of $R_n^{0.59}$ for use in Equation 7-4 are given in Table 721.2.1.2(1). Calculated fire-resistance ratings are shown in Table 721.2.1.2(2).

TABLE 721.2.1.2(1)
VALUES OF $R_n^{0.59}$ FOR USE IN EQUATION 7-4

TYPE OF MATERIAL	THICKNESS OF MATERIAL (inches)											
	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7
Siliceous aggregate concrete	5.3	6.5	8.1	9.5	11.3	13.0	14.9	16.9	18.8	20.7	22.8	25.1
Carbonate aggregate concrete	5.5	7.1	8.9	10.4	12.0	14.0	16.2	18.1	20.3	21.9	24.7	27.2[c]
Sand-lightweight concrete	6.5	8.2	10.5	12.8	15.5	18.1	20.7	23.3	26.0[c]	Note c	Note c	Note c
Lightweight concrete	6.6	8.8	11.2	13.7	16.5	19.1	21.9	24.7	27.8[c]	Note c	Note c	Note c
Insulating concrete[a]	9.3	13.3	16.6	18.3	23.1	26.5[c]	Note c	Note c	Note c	Note c	Note c	Note c
Airspace[b]	—	—	—	—	—	—	—	—	—	—	—	—

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m^3.

a. Dry unit weight of 35 pcf or less and consisting of cellular, perlite or vermiculite concrete.

b. The $R_n^{0.59}$ value for one 1/2" to 3 1/2" airspace is 3.3. The $R_n^{0.59}$ value for two 1/2" to 3 1/2" airspaces is 6.7.

c. The fire-resistance rating for this thickness exceeds 4 hours.

TABLE 721.2.1.2(2)
FIRE-RESISTANCE RATINGS BASED ON $R^{0.59}$

R[a], MINUTES	$R^{0.59}$
60	11.20
120	16.85
180	21.41
240	25.37

a. Based on Equation 7-4.

721.2.1.2.2 Foam plastic insulation. The fire-resistance ratings of precast concrete wall panels consisting of a layer of foam plastic insulation sandwiched between two wythes of concrete shall be permitted to be determined by use of Equation 7-4. Foam plastic insulation with a total thickness of less than 1 inch (25 mm) shall be disregarded. The R_n value for thickness of foam plastic insulation of 1 inch (25 mm) or greater, for use in the calculation, is 5 minutes; therefore $R_n^{0.59} = 2.5$.

721.2.1.3 Joints between precast wall panels. Joints between precast concrete wall panels which are not insulated as required by this section shall be considered as openings in walls. Uninsulated joints shall be included in determining the percentage of openings permitted by Table 704.8. Where openings are not permitted or are required by this code to be protected, the provisions of this section shall be used to determine the amount of joint insulation required. Insulated joints shall not be considered openings for purposes of determining compliance with the allowable percentage of openings in Table 704.8.

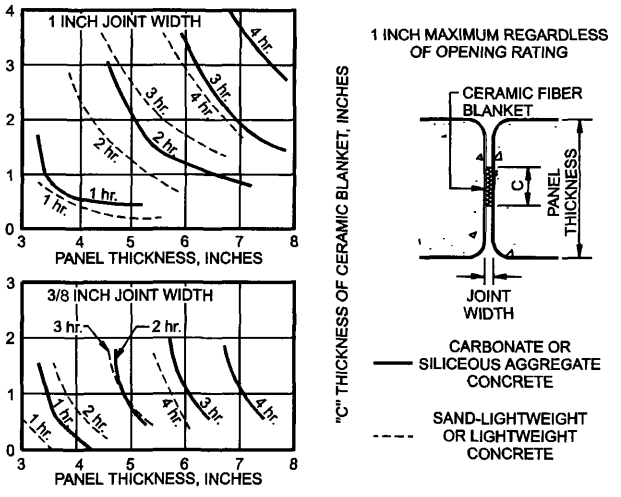
721.2.1.3.1 Ceramic fiber joint protection. Figure 721.2.1.3.1 shows thicknesses of ceramic fiber blankets to be used to insulate joints between precast concrete wall panels for various panel thicknesses and for joint widths of $^3/_8$ inch (9.5 mm) and 1 inch (25 mm) for fire-resistance ratings of 1 hour to 4 hours. For joint widths between $^3/_8$ inch (9.5 mm) and 1 inch (25 mm), the thickness of ceramic fiber blanket is allowed to be determined by direct interpolation. Other tested and labeled materials are acceptable in place of ceramic fiber blankets.

721.2.1.4 Walls with gypsum wallboard or plaster finishes. The fire-resistance rating of cast-in-place or precast concrete walls with finishes of gypsum wallboard or plaster applied to one or both sides shall be permitted to be calculated in accordance with the provisions of this section.

721.2.1.4.1 Nonfire-exposed side. Where the finish of gypsum wallboard or plaster is applied to the side of the wall not exposed to fire, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The thickness of the finish shall first be corrected by multiplying the actual thickness of the finish by the applicable factor determined from Table 721.2.1.4(1) based on the type of aggregate in the concrete. The corrected thickness of finish shall then be added to the actual or equivalent thickness of concrete and fire-resistance rating of the concrete and finish determined from Table 721.2.1.1, Figure 721.2.1.2 or Table 721.2.1.2(1).

721.2.1.4.2 Fire-exposed side. Where gypsum wallboard or plaster is applied to the fire-exposed side of the wall, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The time assigned to the finish as established by Table 721.2.1.4(2) shall be added to the fire-resistance rating determined from Table 721.2.1.1 or Figure 721.2.1.2, or Table 721.2.1.2(1) for the concrete alone, or to the rating determined in Section 721.2.1.4.1 for the concrete and finish on the nonfire-exposed side.

721.2.1.4.3 Nonsymmetrical assemblies. For a wall having no finish on one side or different types or thicknesses of finish on each side, the calculation procedures of Sections 721.2.1.4.1 and 721.2.1.4.2 shall be performed twice, assuming either side of the wall



For SI: 1 inch = 25.4 mm.

FIGURE 721.2.1.3.1
CERAMIC FIBER JOINT PROTECTION

TABLE 721.2.1.4(1)
MULTIPLYING FACTOR FOR FINISHES ON NONFIRE-EXPOSED SIDE OF WALL

TYPE OF FINISH APPLIED TO MASONRY WALL	TYPE OF AGGREGATE USED IN CONCRETE OR CONCRETE MASONRY			
	Concrete: siliceous or carbonate Masonry: siliceous or calcareous gravel	Concrete: sand lightweight concrete Masonry: limestone, cinders or unexpanded slag	Concrete: lightweight concrete Masonry: expanded shale, clay or slate	Concrete: pumice, or expanded slag
Portland cement-sand plaster	1.00	0.75[a]	0.75[a]	0.50[a]
Gypsum-sand plaster or gypsum wallboard	1.25	1.00	1.00	1.00
Gypsum-vermiculite or perlite plaster	1.75	1.50	1.50	1.25

For SI: 1 inch = 25.4 mm.

a. For portland cement-sand plaster $^5/_8$ inch or less in thickness and applied directly to the masonry on the nonfire-exposed side of the wall, the multiplying factor shall be 1.00.

TABLE 721.2.1.4(2)
TIME ASSIGNED TO FINISH MATERIALS ON FIRE-EXPOSED SIDE OF WALL

FINISH DESCRIPTION	TIME (minute)
Gypsum wallboard	
$^3/_8$ inch	10
$^1/_2$ inch	15
$^5/_8$ inch	20
2 layers of $^3/_8$ inch	25
1 layer $^3/_8$ inch, 1 layer $^1/_2$ inch	35
2 layers $^1/_2$ inch	40
Type X gypsum wallboard	
$^1/_2$ inch	25
$^5/_8$ inch	40
Portland cement-sand plaster applied directly to concrete masonry	See Note a
Portland cement-sand plaster on metal lath	
$^3/_4$ inch	20
$^7/_8$ inch	25
1 inch	30
Gypsum sand plaster on $^3/_8$-inch gypsum lath	
$^1/_2$ inch	35
$^5/_8$ inch	40
$^3/_4$ inch	50
Gypsum sand plaster on metal lath	
$^3/_4$ inch	50
$^7/_8$ inch	60
1 inch	80

For SI: 1 inch = 25.4 mm.

a. The actual thickness of portland cement-sand plaster, provided it is $^5/_8$ inch or less in thickness, shall be permitted to be included in determining the equivalent thickness of the masonry for use in Table 721.3.2.

to be the fire-exposed side. The fire-restance rating of the wall shall not exceed the lower of the two values.

Exception: For an exterior wall with more than 5 feet (1524 mm) of horizontal separation, the fire shall be assumed to occur on the interior side only.

721.2.1.4.4 Minimum concrete fire-resistance rating. Where finishes applied to one or both sides of a concrete wall contribute to the fire-resistance rating, the concrete alone shall provide not less than one-half of the total required fire-resistance rating. Additionally, the contribution to the fire resistance of the finish on the nonfire-exposed side of a load-bearing wall shall not exceed one-half the contribution of the concrete alone.

721.2.1.4.5 Concrete finishes. Finishes on concrete walls that are assumed to contribute to the total fire-resistance rating of the wall shall comply with the installation requirements of Section 721.3.2.5.

721.2.2 Concrete floor and roof slabs. Reinforced and prestressed floors and roofs shall comply with Section 721.2.2.1. Multicourse floors and roofs shall comply with Sections 721.2.2.2 and 721.2.2.3, respectively.

721.2.2.1 Reinforced and prestressed floors and roofs. The minimum thicknesses of reinforced and prestressed concrete floor or roof slabs for fire-resistance ratings of 1 hour to 4 hours are shown in Table 721.2.2.1.

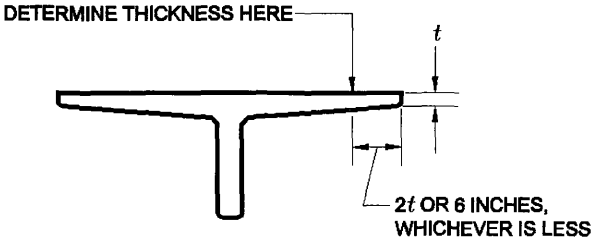
TABLE 721.2.2.1
MINIMUM SLAB THICKNESS (inches)

CONCRETE TYPE	FIRE-RESISTANCE RATING (hour)				
	1	1 1/2	2	3	4
Siliceous	3.5	4.3	5.0	6.2	7.0
Carbonate	3.2	4.0	4.6	5.7	6.6
Sand-lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

For SI: 1 inch = 25.4 mm.

721.2.2.1.1 Hollow-core prestressed slabs. For hollow-core prestressed concrete slabs in which the cores are of constant cross section throughout the length, the equivalent thickness shall be permitted to be obtained by dividing the net cross-sectional area of the slab including grout in the joints, by its width.

721.2.2.1.2 Slabs with sloping soffits. The thickness of slabs with sloping soffits (see Figure 721.2.2.1.2) shall be determined at a distance $2t$ or 6 inches (152 mm), whichever is less, from the point of minimum thickness, where t is the minimum thickness.



For SI: 1 inch = 25.4 mm.

FIGURE 721.2.2.1.2
DETERMINATION OF SLAB THICKNESS FOR SLOPING SOFFITS

721.2.2.1.3 Slabs with ribbed soffits. The thickness of slabs with ribbed or undulating soffits (see Figure 721.2.2.1.3) shall be determined by one of the following expressions, whichever is applicable:

For $s > 4t$, the thickness to be used shall be t

For $s \le 2t$, the thickness to be used shall be t_e

For $4t > s > 2t$, the thickness to be used shall be

$$t + \left(\frac{4t}{s} - 1\right)\left(t_e - t\right) \qquad \textbf{(Equation 7-5)}$$

where:

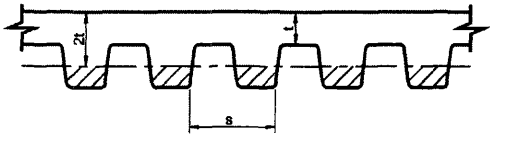
s = Spacing of ribs or undulations.

t = Minimum thickness.

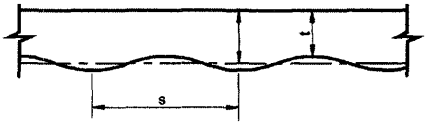
t_e = Equivalent thickness of the slab calculated as the net area of the slab divided by the width, in which the maximum thickness used in the calculation shall not exceed $2t$.

721.2.2.2 Multicourse floors. The fire-resistance ratings of floors that consist of a base slab of concrete with a topping (overlay) of a different type of concrete shall comply with Figure 721.2.2.2.

721.2.2.3 Multicourse roofs. The fire-resistance ratings of roofs which consist of a base slab of concrete with a topping (overlay) of an insulating concrete or with an insulating board and built-up roofing shall comply with Figures 721.2.2.3(1) and 721.2.2.3(2).

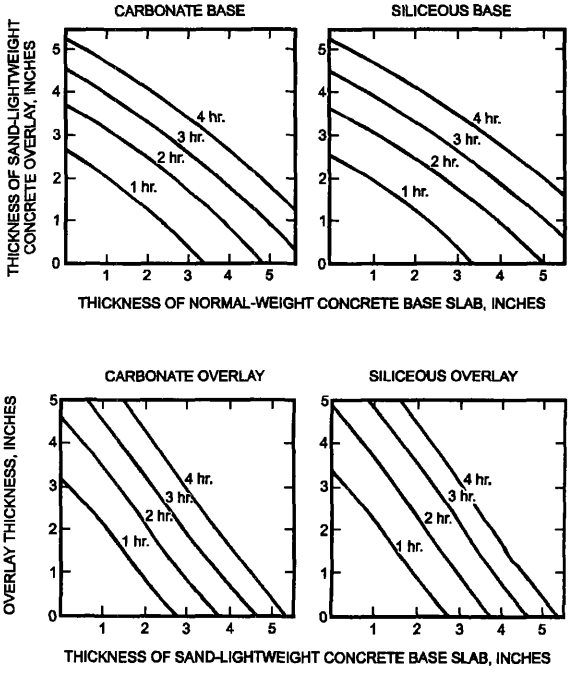


NEGLECT SHADED AREA IN CALCULATION OF EQUIVALENT THICKNESS



For SI: 1 inch = 25.4 mm.

FIGURE 721.2.2.1.3
SLABS WITH RIBBED OR UNDULATING SOFFITS



For SI: 1 inch = 25.4 mm.

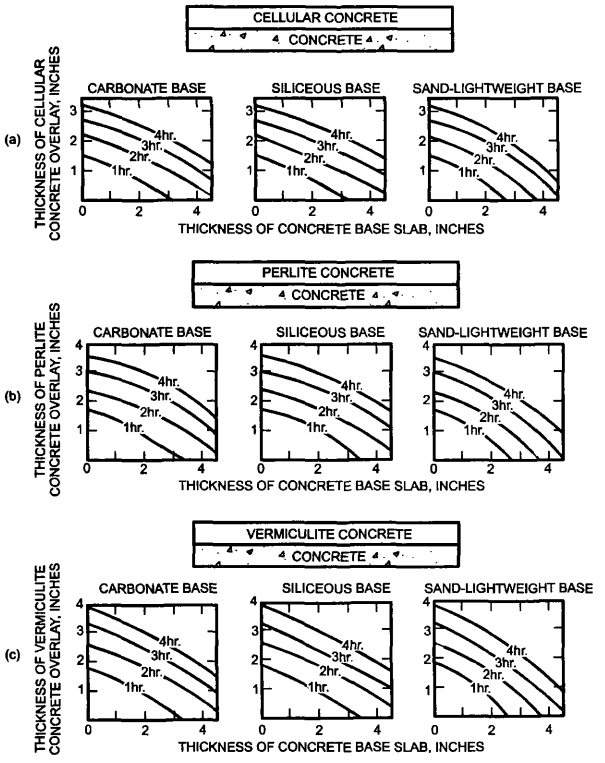
FIGURE 721.2.2.2
FIRE-RESISTANCE RATINGS FOR TWO-COURSE CONCRETE FLOORS

721.2.2.3.1 Heat transfer. For the transfer of heat, three-ply built-up roofing contributes 10 minutes to the fire-resistance rating. The fire-resistance rating for concrete assemblies such as those shown in Figure 721.2.2.3(1) shall be increased by 10 minutes. This increase is not applicable to those shown in Figure 721.2.2.3(2).

721.2.2.4 Joints in precast slabs. Joints between adjacent precast concrete slabs need not be considered in calculating the slab thickness provided that a concrete topping at least 1 inch (25 mm) thick is used. Where no concrete topping is used, joints must be grouted to a depth of at least one-third the slab thickness at the joint, but not less than 1 inch (25 mm), or the joints must be made fire resistant by other approved methods.

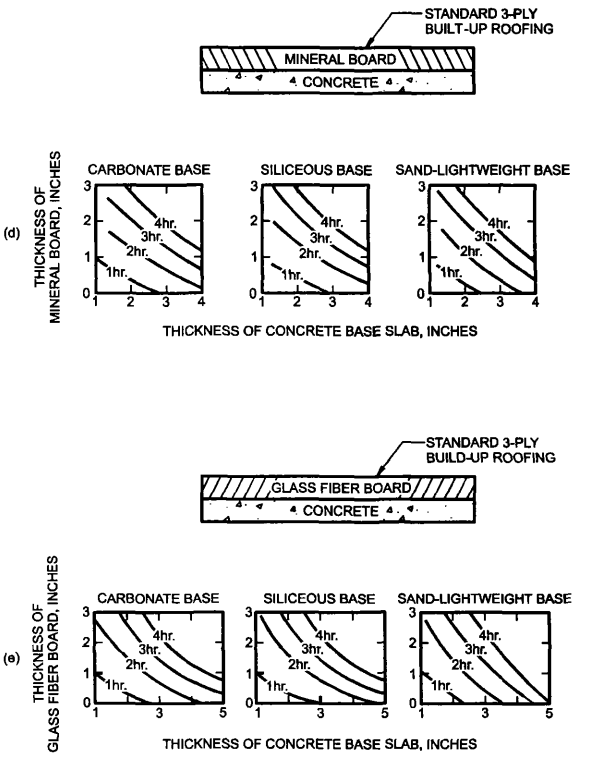
721.2.3 Concrete cover over reinforcement. The minimum thickness of concrete cover over reinforcement in concrete slabs, reinforced beams and prestressed beams shall comply with this section.

721.2.3.1 Slab cover. The minimum thickness of concrete cover to the positive moment reinforcement shall comply with Table 721.2.3(1) for reinforced concrete and Table 721.2.3(2) for prestressed concrete. These tables are applicable for solid or hollow-core one-way or two-way slabs with flat undersurfaces. These tables are applicable to slabs that are either cast in place or precast. For precast prestressed concrete not covered elsewhere,



For SI: 1 inch = 25.4 mm.

FIGURE 721.2.2.3(1)
FIRE-RESISTANCE RATINGS FOR CONCRETE



For SI: 1 inch = 25.4 mm.

FIGURE 721.2.2.3(2)
FIRE-RESISTANCE RATINGS FOR CONCRETE

TABLE 721.2.3(1)
COVER THICKNESS FOR REINFORCED CONCRETE FLOOR OR ROOF SLABS (inches)

	FIRE-RESISTANCE RATING (hours)									
	Restrained					Unrestrained				
CONCRETE AGGREGATE TYPE	1	1 1/2	2	3	4	1	1 1/2	2	3	4
Siliceous	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1	1 1/4	1 5/8
Carbonate	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1 1/4	1 1/4
Sand-lightweight or lightweight	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1 1/4	1 1/4

For SI: 1 inch = 25.4 mm.

the procedures contained in PCI MNL 124 shall be acceptable.

721.2.3.2 Reinforced beam cover. The minimum thickness of concrete cover to the positive moment reinforcement (bottom steel) for reinforced concrete beams is shown in Table 721.2.3(3) for fire-resistance ratings of 1 hour to 4 hours.

721.2.3.3 Prestressed beam cover. The minimum thickness of concrete cover to the positive moment prestressing tendons (bottom steel) for restrained and unrestrained prestressed concrete beams and stemmed units shall comply with the values shown in Tables 721.2.3(4) and 721.2.3(5) for fire-resistance ratings of 1 hour to 4 hours. Values in Table 721.2.3(4) apply to beams 8 inches (203 mm) or greater in width. Values in Table 721.2.3(5) apply to beams or stems of any width, provided the cross-section area is not less than 40 square inches (25 806 mm^2). In case of differences between the values determined from Table 721.2.3(4) or 721.2.3(5), it is permitted to use the smaller value. The concrete cover shall be calculated in accordance with Section 721.2.3.3.1. The minimum concrete cover for nonprestressed reinforcement in prestressed concrete beams shall comply with Section 721.2.3.2.

721.2.3.3.1 Calculating concrete cover. The concrete cover for an individual tendon is the minimum thickness of concrete between the surface of the tendon and the fire-exposed surface of the beam, except that for ungrouted ducts, the assumed cover thickness is the minimum thickness of concrete between the surface of the duct and the fire-exposed surface of the beam. For beams in which two or more tendons are used, the cover is assumed to be the average of the minimum cover of the individual tendons. For corner tendons (tendons equal distance from the bottom and side), the minimum cover used in the calculation shall be one-half the actual value. For stemmed members with two or more prestressing tendons located along the vertical centerline of the stem, the average cover shall be the distance from the bottom of the member to the centroid of the tendons. The actual cover for any individual tendon shall not be less than one-half the smaller value shown in Tables 721.2.3(4) and 721.2.3(5), or 1 inch (25 mm), whichever is greater.

TABLE 721.2.3(2)
COVER THICKNESS FOR PRESTRESSED CONCRETE FLOOR OR ROOF SLABS (inches)

	FIRE-RESISTANCE RATING (hours)									
	Restrained					Unrestrained				
CONCRETE AGGREGATE TYPE	1	1 1/2	2	3	4	1	1 1/2	2	3	4
Siliceous	3/4	3/4	3/4	3/4	3/4	1 1/8	1 1/2	1 3/4	2 3/8	2 3/4
Carbonate	3/4	3/4	3/4	3/4	3/4	1	1 3/8	1 5/8	2 1/8	2 1/4
Sand-lightweight or lightweight	3/4	3/4	3/4	3/4	3/4	1	1 3/8	1 1/2	2	2 1/4

For SI: 1 inch = 25.4 mm.

TABLE 721.2.3(3)
MINIMUM COVER FOR MAIN REINFORCING BARS OF REINFORCED CONCRETE BEAMS[c]
(APPLICABLE TO ALL TYPES OF STRUCTURAL CONCRETE)

RESTRAINED OR UNRESTRAINED[a]	BEAM WIDTH[b] (inches)	FIRE-RESISTANCE RATING (hours)				
		1	1 1/2	2	3	4
Restrained	5	3/4	3/4	3/4	1[a]	1 1/4[a]
	7	3/4	3/4	3/4	3/4	3/4
	≥ 10	3/4	3/4	3/4	3/4	3/4
Unrestrained	5	3/4	1	1 1/4	—	—
	7	3/4	3/4	3/4	1 3/4	3
	≥ 10	3/4	3/4	3/4	1	1 3/4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of 3/4 inch is adequate for ratings of 4 hours or less.

b. For beam widths between the tabulated values, the minimum cover thickness can be determined by direct interpolation.

c. The cover for an individual reinforcing bar is the minimum thickness of concrete between the surface of the bar and the fire-exposed surface of the beam. For beams in which several bars are used, the cover for corner bars used in the calculation shall be reduced to one-half of the actual value. The cover for an individual bar must be not less than one-half of the value given in Table 721.2.3(3) nor less than 3/4 inch.

TABLE 721.2.3(4)
MINIMUM COVER FOR PRESTRESSED CONCRETE BEAMS 8 INCHES OR GREATER IN WIDTH

RESTRAINED OR UNRESTRAINED[a]	CONCRETE AGGREGATE TYPE	BEAM WIDTH[b] (inches)	FIRE-RESISTANCE RATING (hours)				
			1	1 1/2	2	3	4
Restrained	Carbonate or siliceous	8	1 1/2	1 1/2	1 1/2	1 3/4[a]	2 1/2[a]
	Carbonate or siliceous	≥ 12	1 1/2	1 1/2	1 1/2	1 1/2	1 7/8[a]
	Sand lightweight	8	1 1/2	1 1/2	1 1/2	1 1/2	2[a]
	Sand lightweight	≥ 12	1 1/2	1 1/2	1 1/2	1 1/2	1 5/8[a]
Unrestrained	Carbonate or siliceous	8	1 1/2	1 3/4	2 1/2	5[c]	—
	Carbonate or siliceous	≥ 12	1 1/2	1 1/2	1 7/8[a]	2 1/2	3
	Sand lightweight	8	1 1/2	1 1/2	2	3 1/4	—
	Sand lightweight	≥ 12	1 1/2	1 1/2	1 5/8	2	2 1/2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of 3/4 inch is adequate for 4-hour ratings or less.

b. For beam widths between 8 inches and 12 inches, minimum cover thickness can be determined by direct interpolation.

c. Not practical for 8-inch-wide beam but shown for purposes of interpolation.

TABLE 721.2.3(5)
MINIMUM COVER FOR PRESTRESSED CONCRETE BEAMS OF ALL WIDTHS

RESTRAINED OR UNRESTRAINED[a]	CONCRETE AGGREGATE TYPE	BEAM AREA[b] A (square inches)	FIRE-RESISTANCE RATING (hours)				
			1	1 1/2	2	3	4
Restrained	All	40 ≤ A ≤ 150	1 1/2	1 1/2	2	2 1/2	—
	Carbonate or siliceous	150 < A ≤ 300	1 1/2	1 1/2	1 1/2	1 3/4	2 1/2
		300 < A	1 1/2	1 1/2	1 1/2	1 1/2	2
	Sand lightweight	150 < A	1 1/2	1 1/2	1 1/2	1 1/2	2
Unrestrained	All	40 ≤ A ≤ 150	2	2 1/2	—	—	—
	Carbonate or siliceous	150 < A ≤ 300	1 1/2	1 3/4	2 1/2	—	—
		300 < A	1 1/2	1 1/2	2	3[c]	4[c]
	Sand lightweight	150 < A	1 1/2	1 1/2	2	3[c]	4[c]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of 3/4 inch is adequate for 4-hour ratings or less.

b. The cross-sectional area of a stem is permitted to include a portion of the area in the flange, provided the width of the flange used in the calculation does not exceed three times the average width of the stem.

c. U-shaped or hooped stirrups spaced not to exceed the depth of the member and having a minimum cover of 1 inch shall be provided.

721.2.4 Concrete columns. Concrete columns shall comply with this section.

TABLE 721.2.4
MINIMUM DIMENSION OF CONCRETE COLUMNS (inches)

TYPES OF CONCRETE	FIRE-RESISTANCE RATING (hours)				
	1	1 1/2	2[a]	3[a]	4[b]
Siliceous	8	9	10	12	14
Carbonate	8	9	10	11	12
Sand-lightweight	8	8 1/2	9	10 1/2	12

For SI: 1 inch = 25 mm.

a. The minimum dimension is permitted to be reduced to 8 inches for rectangular columns with two parallel sides at least 36 inches in length.

b. The minimum dimension is permitted to be reduced to 10 inches for rectangular columns with two parallel sides at least 36 inches in length.

721.2.4.1 Minimum size. The minimum overall dimensions of reinforced concrete columns for fire-resistance ratings of 1 hour to 4 hours shall comply with Table 721.2.4.

721.2.4.2 Minimum cover for R/C columns. The minimum thickness of concrete cover to the main longitudinal reinforcement in columns, regardless of the type of aggregate used in the concrete, shall not be less than 1 inch (25 mm) times the number of hours of required fire resistance or 2 inches (51 mm), whichever is less.

721.2.4.3 Columns built into walls. The minimum dimensions of Table 721.2.4 do not apply to a reinforced concrete column that is built into a concrete or masonry wall provided all of the following are met:

1. The fire-resistance rating for the wall is equal to or greater than the required rating of the column;
2. The main longitudinal reinforcing in the column has cover not less than that required by Section 721.2.4.2; and

3. Openings in the wall are protected in accordance with Table 715.4.

Where openings in the wall are not protected as required by Section 715.4, the minimum dimension of columns required to have a fire-resistance rating of 3 hours or less shall be 8 inches (203 mm), and 10 inches (254 mm) for columns required to have a fire-resistance rating of 4 hours, regardless of the type of aggregate used in the concrete.

721.2.4.4 Precast cover units for steel columns. See Section 721.5.1.4.

721.3 Concrete masonry. The provisions of this section contain procedures by which the fire-resistance ratings of concrete masonry are established by calculations.

721.3.1 Equivalent thickness. The equivalent thickness of concrete masonry construction shall be determined in accordance with the provisions of this section.

721.3.1.1 Concrete masonry unit plus finishes. The equivalent thickness of concrete masonry assemblies, T_{ea}, shall be computed as the sum of the equivalent thickness of the concrete masonry unit, T_e, as determined by Section 721.3.1.2, 721.3.1.3, or 721.3.1.4, plus the equivalent thickness of finishes, T_{ef}, determined in accordance with Section 721.3.2:

$$T_{ea} = T_e + T_{ef} \qquad \textbf{(Equation 7-6)}$$

$T_e = V_n/LH$ = Equivalent thickness of concrete masonry unit (inch) (mm).

where:

V_n = Net volume of masonry unit (inch^3) (mm^3).

L = Specified length of masonry unit (inch) (mm).

H = Specified height of masonry unit (inch) (mm).

721.3.1.2 Ungrouted or partially grouted construction. T_e shall be the value obtained for the concrete masonry unit determined in accordance with ASTM C 140.

721.3.1.3 Solid grouted construction. The equivalent thickness, T_e, of solid grouted concrete masonry units is the actual thickness of the unit.

721.3.1.4 Airspaces and cells filled with loose-fill material. The equivalent thickness of completely filled hollow concrete masonry is the actual thickness of the unit when loose-fill materials are: sand, pea gravel, crushed stone, or slag that meet ASTM C 33 requirements; pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders that comply with ASTM C 331; or perlite or vermiculite meeting the requirements of ASTM C 549 and ASTM C 516, respectively.

721.3.2 Concrete masonry walls. The fire-resistance rating of walls and partitions constructed of concrete masonry units shall be determined from Table 721.3.2. The rating shall be based on the equivalent thickness of the masonry and type of aggregate used.

721.3.2.1 Finish on nonfire-exposed side. Where plaster or gypsum wallboard is applied to the side of the wall not exposed to fire, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The thickness of gypsum wallboard or plaster shall be corrected by multiplying the actual thickness of the finish by applicable factor determined from Table 721.2.1.4(1). This corrected thickness of finish shall be added to the equivalent thickness of masonry and the fire-resistance rating of the masonry and finish determined from Table 721.3.2.

721.3.2.2 Finish on fire-exposed side. Where plaster or gypsum wallboard is applied to the fire-exposed side of the wall, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The time assigned to the finish as established by Table 721.2.1.4(2) shall be added to the fire-resistance rating determined in Section 721.3.2 for the masonry alone, or in Section 721.3.2.1 for the masonry and finish on the nonfire-exposed side.

TABLE 721.3.2
MINIMUM EQUIVALENT THICKNESS (inches) OF BEARING OR NONBEARING CONCRETE MASONRY WALLS[a,b,c,d]

TYPE OF AGGREGATE	FIRE-RESISTANCE RATING (hours)														
	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4
Pumice or expanded slag	1.5	1.9	2.1	2.5	2.7	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.5	4.7
Expanded shale, clay or slate	1.8	2.2	2.6	2.9	3.3	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	4.9	5.1
Limestone, cinders or unexpanded slag	1.9	2.3	2.7	3.1	3.4	3.7	4.0	4.3	4.5	4.8	5.0	5.2	5.5	5.7	5.9
Calcareous or siliceous gravel	2.0	2.4	2.8	3.2	3.6	3.9	4.2	4.5	4.8	5.0	5.3	5.5	5.8	6.0	6.2

For SI: 1 inch = 25.4 mm.

a. Values between those shown in the table can be determined by direct interpolation.

b. Where combustible members are framed into the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall not be less than 93 percent of the thickness shown in the table.

c. Requirements of ASTM C 55, ASTM C 73 or ASTM C 90 shall apply.

d. Minimum required equivalent thickness corresponding to the hourly fire-resistance rating for units with a combination of aggregate shall be determined by linear interpolation based on the percent by volume of each aggregate used in manufacture.

721.3.2.3 Nonsymmetrical assemblies. For a wall having no finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of this section shall be performed twice, assuming either side of the wall to be the fire-exposed side. The fire-resistance rating of the wall shall not exceed the lower of the two values calculated.

Exception: For exterior walls with more than 5 feet (1524 mm) of horizontal separation, the fire shall be assumed to occur on the interior side only.

721.3.2.4 Minimum concrete masonry fire-resistance rating. Where the finish applied to a concrete masonry wall contributes to its fire-resistance rating, the masonry alone shall provide not less than one-half the total required fire-resistance rating.

721.3.2.5 Attachment of finishes. Installation of finishes shall be as follows:

1. Gypsum wallboard and gypsum lath applied to concrete masonry or concrete walls shall be secured to wood or steel furring members spaced not more than 16 inches (406 mm) on center (o.c.).
2. Gypsum wallboard shall be installed with the long dimension parallel to the furring members and shall have all joints finished.
3. Other aspects of the installation of finishes shall comply with the applicable provisions of Chapters 7 and 25.

721.3.3 Multiwythe masonry walls. The fire-resistance rating of wall assemblies constructed of multiple wythes of masonry materials shall be permitted to be based on the fire-resistance rating period of each wythe and the continuous airspace between each wythe in accordance with the following formula:

$$R_A = (R_1^{0.59} + R_2^{0.59} + \ldots + R_n^{0.59} + A_1 + A_2 + \ldots + A_n)^{1.7} \quad \textbf{(Equation 7-7)}$$

where:

R_A = Fire-resistance rating of the assembly (hours).

$R_1, R_2, \ldots, R_n$ = Fire-resistance rating of wythes for 1, 2, n (hours), respectively.

$A_1, A_2, \ldots, A_n$ = 0.30, factor for each continuous airspace for $1, 2, \ldots n$, respectively, having a depth of $^1/_2$ inch (12.7 mm) or more between wythes.

721.3.4 Concrete masonry lintels. Fire-resistance ratings for concrete masonry lintels shall be determined based upon the nominal thickness of the lintel and the minimum thickness of concrete masonry or concrete, or any combination thereof, covering the main reinforcing bars, as determined according to Table 721.3.4, or by approved alternate methods.

TABLE 721.3.4
MINIMUM COVER OF LONGITUDINAL REINFORCEMENT IN FIRE-RESISTANCE-RATED REINFORCED CONCRETE MASONRY LINTELS (inches)

NOMINAL WIDTH OF LINTEL (inches)	FIRE-RESISTANCE RATING (hours)			
	1	2	3	4
6	$1^1/_2$	2	—	—
8	$1^1/_2$	$1^1/_2$	$1^3/_4$	3
10 or greater	$1^1/_2$	$1^1/_2$	$1^1/_2$	$1^3/_4$

For SI: 1 inch = 25.4 mm.

721.3.5 Concrete masonry columns. The fire-resistance rating of concrete masonry columns shall be determined based upon the least plan dimension of the column in accordance with Table 721.3.5 or by approved alternate methods.

TABLE 721.3.5
MINIMUM DIMENSION OF CONCRETE MASONRY COLUMNS (inches)

FIRE-RESISTANCE RATING (hours)			
1	2	3	4
8 inches	10 inches	12 inches	14 inches

For SI: 1 inch = 25.4 mm.

721.4 Clay brick and tile masonry. The provisions of this section contain procedures by which the fire-resistance ratings of clay brick and tile masonry are established by calculations.

721.4.1 Masonry walls. The fire-resistance rating of masonry walls shall be based upon the equivalent thickness as calculated in accordance with this section. The calculation shall take into account finishes applied to the wall and airspaces between wythes in multiwythe construction.

721.4.1.1 Equivalent thickness. The fire-resistance ratings of walls or partitions constructed of solid or hollow clay masonry units shall be determined from Table 721.4.1(1) or 721.4.1(2). The equivalent thickness of the clay masonry unit shall be determined by Equation 7-8 when using Table 721.4.1(1). The fire-resistance rating determined from Table 721.4.1(1) shall be permitted to be used in the calculated fire-resistance rating procedure in Section 721.4.2.

$$T_e = V_n / LH \quad \textbf{(Equation 7-8)}$$

where:

T_e = The equivalent thickness of the clay masonry unit (inches).

V_n = The net volume of the clay masonry unit (inch^3).

TABLE 721.4.1(1)
FIRE-RESISTANCE PERIODS OF CLAY MASONRY WALLS

MATERIAL TYPE	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE RESISTANCE[a,b,c] (inches)			
	1 hour	2 hour	3 hour	4 hour
Solid brick of clay or shale[d]	2.7	3.8	4.9	6.0
Hollow brick or tile of clay or shale, unfilled	2.3	3.4	4.3	5.0
Hollow brick or tile of clay or shale, grouted or filled with materials specified in Section 721.4.1.1.3	3.0	4.4	5.5	6.6

For SI: 1 inch = 25.4 mm.

a. Equivalent thickness as determined from Section 721.4.1.1.

b. Calculated fire resistance between the hourly increments listed shall be determined by linear interpolation.

c. Where combustible members are framed in the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall not be less than 93 percent of the thickness shown.

d. For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is at least 75 percent of the gross cross-sectional area measured in the same plane.

TABLE 721.4.1(2)
FIRE-RESISTANCE RATINGS FOR BEARING STEEL FRAME BRICK VENEER WALLS OR PARTITIONS

WALL OR PARTITION ASSEMBLY	PLASTER SIDE EXPOSED (hours)	BRICK FACED SIDE EXPOSED (hours)
Outside facing of steel studs: $^1/_2$" wood fiberboard sheathing next to studs, $^3/_4$" airspace formed with $^3/_4$" × 1 $^5/_8$" wood strips placed over the fiberboard and secured to the studs; metal or wire lath nailed to such strips, 3 $^3/_4$" brick veneer held in place by filling $^3/_4$" airspace between the brick and lath with mortar. Inside facing of studs: $^3/_4$" unsanded gypsum plaster on metal or wire lath attached to $^5/_{16}$" wood strips secured to edges of the studs.	1.5	4
Outside facing of steel studs: 1" insulation board sheathing attached to studs, 1" airspace, and 3 $^3/_4$" brick veneer attached to steel frame with metal ties every 5th course. Inside facing of studs: $^7/_8$" sanded gypsum plaster (1:2 mix) applied on metal or wire lath attached directly to the studs.	1.5	4
Same as above except use $^7/_8$" vermiculite—gypsum plaster or 1" sanded gypsum plaster (1:2 mix) applied to metal or wire.	2	4
Outside facing of steel studs: $^1/_2$" gypsum sheathing board, attached to studs, and 3 $^3/_4$" brick veneer attached to steel frame with metal ties every 5th course. Inside facing of studs: $^1/_2$" sanded gypsum plaster (1:2 mix) applied to $^1/_2$" perforated gypsum lath securely attached to studs and having strips of metal lath 3 inches wide applied to all horizontal joints of gypsum lath.	2	4

For SI: 1 inch = 25.4 mm.

L = The specified length of the clay masonry unit (inches).

H = The specified height of the clay masonry unit (inches).

721.4.1.1.1 Hollow clay units. The equivalent thickness, T_e, shall be the value obtained for hollow clay units as determined in accordance with ASTM C 67.

721.4.1.1.2 Solid grouted clay units. The equivalent thickness of solid grouted clay masonry units shall be taken as the actual thickness of the units.

721.4.1.1.3 Units with filled cores. The equivalent thickness of the hollow clay masonry units is the actual thickness of the unit when completely filled with loose-fill materials of: sand, pea gravel, crushed stone, or slag that meet ASTM C 33 requirements; pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders in compliance with ASTM C 331; or perlite or vermiculite meeting the requirements of ASTM C 549 and ASTM C 516, respectively.

721.4.1.2 Plaster finishes. Where plaster is applied to the wall, the total fire-resistance rating shall be determined by the formula:

$$R=(R_n^{0.59}+pl)^{1.7} \qquad \textbf{(Equation 7-9)}$$

where:

R = The fire-resistance rating of the assembly (hours).

R_n = The fire-resistance rating of the individual wall (hours).

pl = Coefficient for thickness of plaster.

Values for $R_n^{0.59}$ for use in Equation 7-9 are given in Table 721.4.1(3). Coefficients for thickness of plaster shall be selected from Table 721.4.1(4) based on the actual thickness of plaster applied to the wall or partition and whether one or two sides of the wall are plastered.

721.4.1.3 Multiwythe walls with airspace. Where a continuous airspace separates multiple wythes of the wall or partition, the total fire-resistance rating shall be determined by the formula:

$$R=(R_1^{0.59}+R_2^{0.59}+...+R_n^{0.59}+as)^{1.7} \quad \textbf{(Equation 7-10)}$$

where:

R = The fire-resistance rating of the assembly (hours).

R_1, R_2 and R_n = The fire-resistance rating of the individual wythes (hours).

as = Coefficient for continuous airspace.

Values for $R_n^{0.59}$ for use in Equation 7-10 are given in Table 721.4.1(3). The coefficient for each continuous airspace of $^1/_2$ inch to $3^1/_2$ inches (12.7 to 89 mm) separating two individual wythes shall be 0.3.

TABLE 721.4.1(3)
VALUES OF $R_n^{0.59}$

$R_n^{0.59}$	R (hours)
1	1.0
2	1.50
3	1.91
4	2.27

TABLE 721.4.1(4)
COEFFICIENTS FOR PLASTER, pl [a]

THICKNESS OF PLASTER (inch)	ONE SIDE	TWO SIDE
$^1/_2$	0.3	0.6
$^5/_8$	0.37	0.75
$^3/_4$	0.45	0.90

For SI: 1 inch = 25.4 mm.

a. Values listed in table are for 1:3 sanded gypsum plaster.

TABLE 721.4.1(5)
REINFORCED MASONRY LINTELS

NOMINAL LINTEL WIDTH (inches)	MINIMUM LONGITUDINAL REINFORCEMENT COVER FOR FIRE RESISTANCE (inch)			
	1 hour	2 hour	3 hour	4 hour
6	$1^1/_2$	2	NP	NP
8	$1^1/_2$	$1^1/_2$	$1^3/_4$	3
10 or more	$1^1/_2$	$1^1/_2$	$1^1/_2$	$1^3/_4$

For SI: 1 inch = 25.4 mm.

NP = Not permitted.

TABLE 721.4.1(6)
REINFORCED CLAY MASONRY COLUMNS

COLUMN SIZE	FIRE-RESISTANCE RATING (hour)			
	1	2	3	4
Minimum column dimension (inches)	8	10	12	14

For SI: 1 inch = 25.4 mm.

721.4.1.4 Nonsymmetrical assemblies. For a wall having no finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of this section shall be performed twice, assuming either side to be the fire-exposed side of the wall. The fire resistance of the wall shall not exceed the lower of the two values determined.

Exception: For exterior walls with more than 5 feet (1524 mm) of horizontal separation, the fire shall be assumed to occur on the interior side only.

721.4.2 Multiwythe walls. The fire-resistance rating for walls or partitions consisting of two or more dissimilar wythes shall be permitted to be determined by the formula:

$$R=(R_1^{0.59}+R_2^{0.59}+...+R_n^{0.59})^{1.7} \quad \textbf{(Equation 7-11)}$$

where:

R = The fire-resistance rating of the assembly (hours).

R_1, R_2 and R_n = The fire-resistance rating of the individual wythes (hours).

Values for $R_n^{0.59}$ for use in Equation 7-11 are given in Table 721.4.1(3).

721.4.2.1 Multiwythe walls of different material. For walls that consist of two or more wythes of different materials (concrete or concrete masonry units) in combination with clay masonry units, the fire-resistance rating of the different materials shall be permitted to be determined from Table 721.2.1.1 for concrete; Table 721.3.2 for concrete masonry units or Table 721.4.1(1) or 721.4.1(2) for clay and tile masonry units.

721.4.3 Reinforced clay masonry lintels. Fire-resistance ratings for clay masonry lintels shall be determined based on the nominal width of the lintel and the minimum covering for the longitudinal reinforcement in accordance with Table 721.4.1(5).

721.4.4 Reinforced clay masonry columns. The fire-resistance ratings shall be determined based on the last plan dimension of the column in accordance with Table 721.4.1(6). The minimum cover for longitudinal reinforcement shall be 2 inches (51 mm).

721.5 Steel assemblies. The provisions of this section contain procedures by which the fire-resistance ratings of steel assemblies are established by calculations.

721.5.1 Structural steel columns. The fire-resistance ratings of steel columns shall be based on the size of the element and the type of protection provided in accordance with this section.

TABLE 721.5.1(1)
***W/D* RATIOS FOR STEEL COLUMNS**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W14 × 233	2.49	3.65	W10 × 112	1.78	2.57
× 211	2.28	3.35	× 100	1.61	2.33
× 193	2.10	3.09	× 88	1.43	2.08
× 176	1.93	2.85	× 77	1.26	1.85
× 159	1.75	2.60	× 68	1.13	1.66
× 145	1.61	2.39	× 60	1.00	1.48
× 132	1.52	2.25	× 54	0.91	1.34
× 120	1.39	2.06	× 49	0.83	1.23
× 109	1.27	1.88	× 45	0.87	1.24
× 99	1.16	1.72	× 39	0.76	1.09
× 90	1.06	1.58	× 33	0.65	0.93
× 82	1.20	1.68			
× 74	1.09	1.53	W8 × 67	1.34	1.94
× 68	1.01	1.41	× 58	1.18	1.71
× 61	0.91	1.28	× 48	0.99S	1.44
× 53	0.89	1.21	× 40	0.83	1.23
× 48	0.81	1.10	× 35	0.73	1.08
× 43	0.73	0.99	× 31	0.65	0.97
			× 28	0.67	0.96
W12 × 190	2.46	3.51	× 24	0.58	0.83
× 170	2.22	3.20	× 21	0.57	0.77
× 152	2.01	2.90	× 18	0.49	0.67
× 136	1.82	2.63			
× 120	1.62	2.36	W6 × 25	0.69	1.00
× 106	1.44	2.11	× 20	0.56	0.82
× 96	1.32	1.93	× 16	0.57	0.78
× 87	1.20	1.76	× 15	0.42	0.63
× 79	1.10	1.61	× 12	0.43	0.60
× 72	1.00	1.48	× 9	0.33	0.46
× 65	0.91	1.35			
× 58	0.91	1.31	W5 × 19	0.64	0.93
× 53	0.84	1.20	× 16	0.54	0.80
× 50	0.89	1.23			
× 45	0.81	1.12	W4 × 13	0.54	0.79
× 40	0.72	1.00			

For SI: 1 pound per linear foot per inch = 0.059 kg/m/mm.

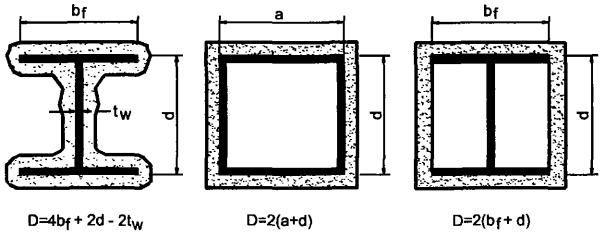


FIGURE 721.5.1(1)
DETERMINATION OF THE HEATED PERIMETER OF STRUCTURAL STEEL COLUMNS

721.5.1.1 General. These procedures establish a basis for determining the fire resistance of column assemblies as a function of the thickness of fire-resistant material and, the weight, *W*, and heated perimeter, *D*, of steel columns. As used in these sections, *W* is the average weight of a structural steel column in pounds per linear foot. The heated perimeter, *D*, is the inside perimeter of the fire-resistant material in inches as illustrated in Figure 721.5.1(1).

721.5.1.1.1 Nonload-bearing protection. The application of these procedures shall be limited to column assemblies in which the fire-resistant material is not designed to carry any of the load acting on the column.

721.5.1.1.2 Embedments. In the absence of substantiating fire-endurance test results, ducts, conduit, piping, and similar mechanical, electrical, and plumbing

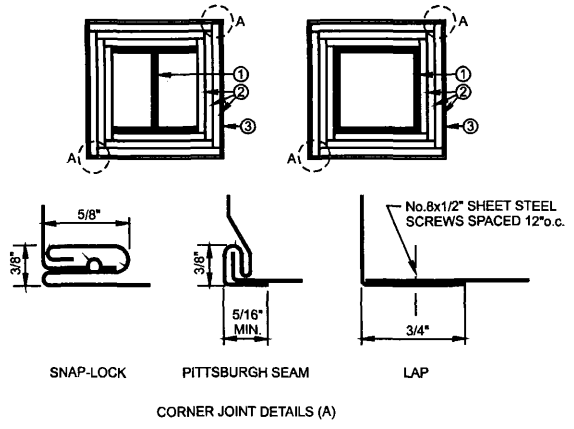


FIGURE 721.5.1(2)
GYPSUM WALLBOARD PROTECTED STRUCTURAL STEEL COLUMNS WITH SHEET STEEL COLUMN COVERS

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

1. Structural steel column, either wide flange or tubular shapes.
2. Type X gypsum wallboard in accordance with ASTM C 36. For single-layer applications, the wallboard shall be applied vertically with no horizontal joints. For multiple-layer applications, horizontal joints are permitted at a minimum spacing of 8 feet, provided that the joints in successive layers are staggered at least 12 inches. The total required thickness of wallboard shall be determined on the basis of the specified fire-resistance rating and the weight-to-heated-perimeter ratio (*W/D*) of the column. For fire-resistance ratings of 2 hours or less, one of the required layers of gypsum wallboard may be applied to the exterior of the sheet steel column covers with 1-inch-long Type S screws spaced 1 inch from the wallboard edge and 8 inches on center. For such installations, 0.0149-inch minimum thickness galvanized steel corner beads with $1^1/_2$-inch legs shall be attached to the wallboard with Type S screws spaced 12 inches on center.
3. For fire-resistance ratings of 3 hours or less, the column covers shall be fabricated from 0.0239-inch minimum thickness galvanized or stainless steel. For 4-hour fire-resistance ratings, the column covers shall be fabricated from 0.0239-inch minimum thickness stainless steel. The column covers shall be erected with the Snap Lock or Pittsburgh joint details.

   For fire-resistance ratings of 2 hours or less, column covers fabricated from 0.0269-inch minimum thickness galvanized or stainless steel shall be permitted to be erected with lap joints. The lap joints shall be permitted to be located anywhere around the perimeter of the column cover. The lap joints shall be secured with $^1/_2$-inch-long No. 8 sheet metal screws spaced 12 inches on center.

   The column covers shall be provided with a minimum expansion clearance of $^1/_8$ inch per linear foot between the ends of the cover and any restraining construction.

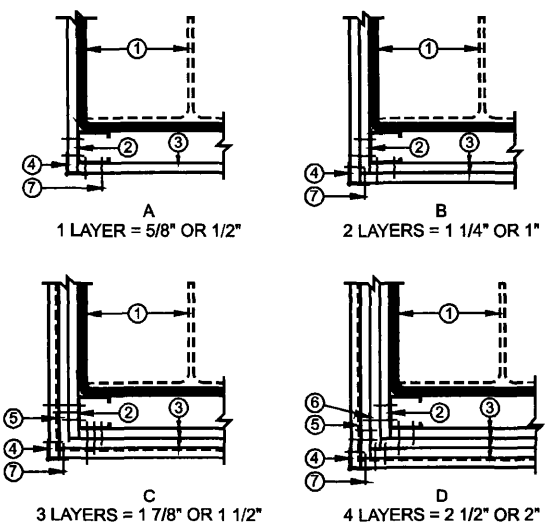
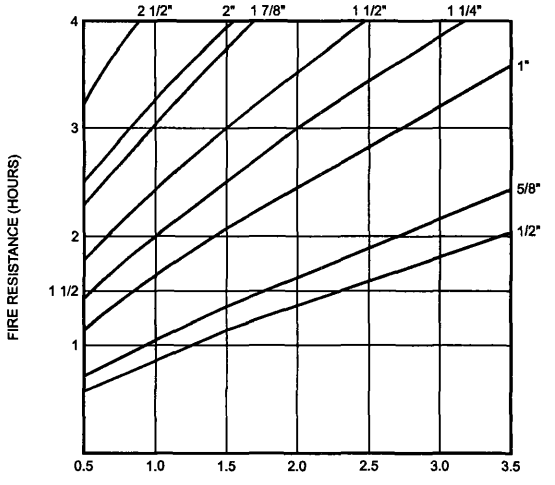


FIGURE 721.5.1(3)
GYPSUM WALLBOARD PROTECTED STRUCTURAL STEEL COLUMNS WITH STEEL STUD/SCREW ATTACHMENT SYSTEM

For SI: 1 inch = 25.4 mm, 1 foot = -305 mm.

1. Structural steel column, either wide flange or tubular shapes.
2. $1^5/_8$-inch deep studs fabricated from 0.0179-inch minimum thickness galvanized steel with $1^5/_{16}$ or $1^7/_{16}$-inch legs. The length of the steel studs shall be $^1/_2$ inch less than the height of the assembly.
3. Type X gypsum wallboard in accordance with ASTM C 36. For single-layer applications, the wallboard shall be applied vertically with no horizontal joints. For multiple-layer applications, horizontal joints are permitted at a minimum spacing of 8 feet, provided that the joints in successive layers are staggered at least 12 inches. The total required thickness of wallboard shall be determined on the basis of the specified fire-resistance rating and the weight-to-heated-perimeter ratio (*W/D*) of the column.
4. Galvanized 0.0149-inch minimum thickness steel corner beads with $1^1/_2$-inch legs attached to the wallboard with 1-inch-long Type S screws spaced 12 inches on center.
5. No. 18 SWG steel tie wires spaced 24 inches on center.
6. Sheet metal angles with 2-inch legs fabricated from 0.0221-inch minimum thickness galvanized steel.
7. Type S screws, 1 inch long, shall be used for attaching the first layer of wallboard to the steel studs and the third layer to the sheet metal angles at 24 inches on center. Type S screws $1^3/_4$-inch long shall be used for attaching the second layer of wallboard to the steel studs and the fourth layer to the sheet metal angles at 12 inches on center. Type S screws $2^1/_4$ inches long shall be used for attaching the third layer of wallboard to the steel studs at 12 inches on center.



For SI: 1 inch = 25.4 mm, 1 pound per linear foot/inch = 0.059 kg/m/mm.

FIGURE 721.5.1(4)
FIRE RESISTANCE OF STRUCTURAL STEEL COLUMNS PROTECTED WITH VARIOUS THICKNESSES OF TYPE X GYPSUM WALLBOARD

a. The *W/D* ratios for typical wide flange columns are listed in Table 721.5.1(1). For other column shapes, the *W/D* ratios shall be determined in accordance with Section 720.5.1.1.

installations shall not be embedded in any required fire-resistant materials.

721.5.1.1.3 Weight-to-perimeter ratio. Table 721.5.1(1) contains weight-to-heated-perimeter ratios (*W/D*) for both contour and box fire-resistant profiles, for the wide flange shapes most often used as columns. For different fire-resistant protection profiles or column cross sections, the weight-to-heated-perimeter ratios (*W/D*) shall be determined in accordance with the definitions given in this section.

721.5.1.2 Gypsum wallboard protection. The fire resistance of structural steel columns with weight-to-heated-perimeter ratios (*W/D*) less than or equal to 3.65 and which are protected with Type X gypsum wall-

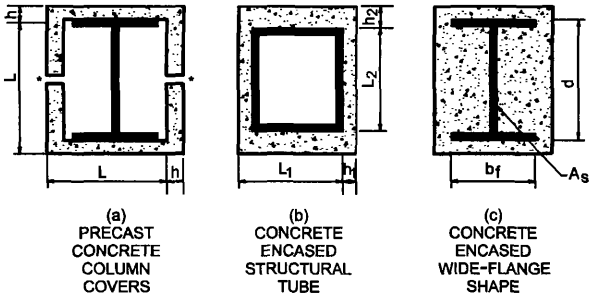


FIGURE 721.5.1(6)
CONCRETE PROTECTED STRUCTURAL STEEL COLUMNS[a,b]

a. When the inside perimeter of the concrete protection is not square, L shall be taken as the average of L_1 and L_2. When the thickness of concrete cover is not constant, h shall be taken as the average of h_1 and h_2.

b. Joints shall be protected with a minimum 1 inch thickness of ceramic fiber blanket but in no case less than one-half the thickness of the column cover (see Section 720.2.1.3).

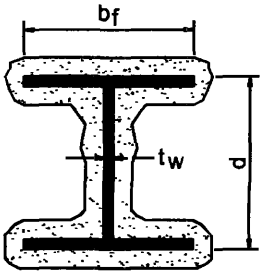


FIGURE 721.5.1(5)
WIDE FLANGE STRUCTURAL STEEL COLUMNS WITH SPRAY-APPLIED FIRE-RESISTANT MATERIALS

board shall be permitted to be determined from the following expression:

$$R = 130\left[\frac{h(W'/D)}{2}\right]^{0.75} \qquad \textbf{(Equation 7-12)}$$

where:

R = Fire resistance (minutes).

h = Total thickness of gypsum wallboard (inches).

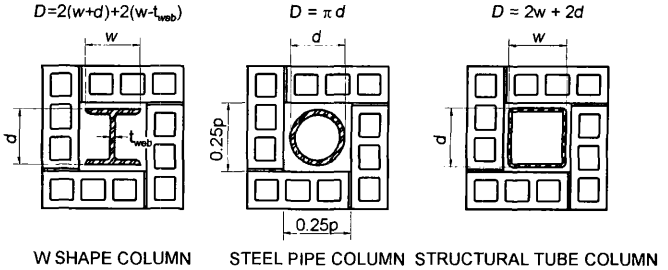
D = Heated perimeter of the structural steel column (inches).

W' = Total weight of the structural steel column and gypsum wallboard protection (pounds per linear foot).

$W' = W + 50hD/144$.

721.5.1.2.1 Attachment. The gypsum wallboard shall be supported as illustrated in either Figure 721.5.1(2) for fire-resistance ratings of 4 hours or less, or Figure 721.5.1(3) for fire-resistance ratings of 3 hours or less.

721.5.1.2.2 Gypsum wallboard equivalent to concrete. The determination of the fire resistance of structural steel columns from Figure 721.5.1(4) is permitted for various thicknesses of gypsum wall-



For SI: 1 inch = 25.4 mm.

FIGURE 721.5.1(7)
CONCRETE OR CLAY MASONRY PROTECTED STRUCTURAL STEEL COLUMNS

d = Depth of a wide flange column, outside diameter of pipe column, or outside dimension of structural tubing column (inches).

t_{web} = Thickness of web of wide flange column (inches).

w = Width of flange of wide flange column (inches).

board as a function of the weight-to-heated-perimeter ratio (*W/D*) of the column. For structural steel columns with weight-to-heated-perimeter ratios (*W/D*) greater than 3.65, the thickness of gypsum wallboard required for specified fire-resistance ratings shall be the same as the thickness determined for a *W*14 x 233 wide flange shape.

721.5.1.3 Spray-applied fire-resistant materials. The fire resistance of wide-flange structural steel columns protected with spray-applied fire-resistant materials, as illustrated in Figure 721.5.1(5), shall be permitted to be determined from the following expression:

$$R = \left[C_1 \left(W / D\right) + C_2\right] h \qquad \textbf{(Equation 7-13)}$$

where:

R = Fire resistance (minutes).

h = Thickness of spray-applied fire-resistant material (inches).

D = Heated perimeter of the structural steel column (inches).

C_1 and C_2 = Material-dependent constants.

W = Weight of structural steel columns (pounds per linear foot).

The fire resistance of structural steel columns protected with intumescent or mastic fire-resistant coatings shall be determined on the basis of fire-resistance tests in accordance with Section 703.2.

721.5.1.3.1 Material-dependent constants. The material-dependent constants, C_1 and C_2, shall be determined for specific fire-resistant materials on the basis of standard fire endurance tests in accordance with Section 703.2. Unless evidence is submitted to the building official substantiating a broader application, this expression shall be limited to determining the fire resistance of structural steel columns with weight-to-heated-perimeter ratios (*W/D*) between the largest and smallest columns for which standard fire-resistance test results are available.

721.5.1.3.2 Spray-applied identification. Spray-applied fire-resistant materials shall be identified by density and thickness required for a given fire-resistance rating.

721.5.1.4 Concrete-protected columns. The fire resistance of structural steel columns protected with concrete, as illustrated in Figure 721.5.1(6) (a) and (b), shall be permitted to be determined from the following expression:

$$R = R_o (1 + 0.03_m) \qquad \textbf{(Equation 7-14)}$$

where:

$R_o = 10\ (W/D)^{0.7} + 17\ (h^{1.6}/k_c^{0.2}) \times (1 + 26\ (H/p_c c_c h\ (L + h))^{0.8})$

As used in these expressions:

R = Fire endurance at equilibrium moisture conditions (minutes).

R_o = Fire endurance at zero moisture content (minutes).

m = Equilibrium moisture content of the concrete by volume (percent).

W = Average weight of the steel column (pounds per linear foot).

D = Heated perimeter of the steel column (inches).

h = Thickness of the concrete cover (inches).

k_c = Ambient temperature thermal conductivity of the concrete (Btu/hr ft °F).

H = Ambient temperature thermal capacity of the steel column = 0.11W (Btu/ ft °F).

p_c = Concrete density (pounds per cubic foot).

c_c = Ambient temperature specific heat of concrete (Btu/lb °F).

L = Interior dimension of one side of a square concrete box protection (inches).

721.5.1.4.1 Reentrant space filled. For wide-flange steel columns completely encased in concrete with all reentrant spaces filled [Figure 721.5.1(6)(c)], the thermal capacity of the concrete within the reentrant spaces shall be permitted to be added to the thermal capacity of the steel column, as follows:

$$H = 0.11W + (p_c c_c/144)\,(b_f d - A_s) \qquad \textbf{(Equation 7-15)}$$

where:

b_f = Flange width of the steel column (inches).

d = Depth of the steel column (inches).

A_s = Cross-sectional area of the steel column (square inches).

721.5.1.4.2 Concrete properties unknown. If specific data on the properties of concrete are not available, the values given in Table 721.5.1(2) are permitted.

721.5.1.4.3 Minimum concrete cover. For structural steel column encased in concrete with all reentrant spaces filled, Figure 721.5.1(6)(c) and Tables 721.5.1(7) and 721.5.1(8) indicate the thickness of concrete cover required for various fire-resistance ratings for typical wide-flange sections. The thicknesses of concrete indicated in these tables also apply to structural steel columns larger than those listed.

721.5.1.4.4 Minimum precast concrete cover. For structural steel columns protected with precast concrete column covers as shown in Figure 721.5.1(6)(a), Tables 721.5.1(9) and 721.5.1(10) indicate the thickness of the column covers required for various fire-resistance ratings for typical wide-flange shapes. The thicknesses of concrete given in these tables also apply to structural steel columns larger than those listed.

721.5.1.4.5 Masonry protection. The fire resistance of structural steel columns protected with concrete masonry units or clay masonry units as illustrated in

Figure 721.5.1(7), shall be permitted to be determined from the following expression:

$$R = 0.17\,(W/D)^{0.7} + [0.285\,(T_e^{1.6}/K^{0.2})\,]\,[1.0 + 42.7\,\{\,(A_s/d_m\,T_e) / (0.25p + T_e)\,\}^{0.8}\,]$$ **(Equation 7-16)**

where:

R = Fire-resistance rating of column assembly (hours).

W = Average weight of steel column (pounds per foot).

D = Heated perimeter of steel column (inches) [see Figure 721.5.1(7)].

T_e = Equivalent thickness of concrete or clay masonry unit (inches) (see Table 721.3.2 Note a or Section 721.4.1).

K = Thermal conductivity of concrete or clay masonry unit (Btu/hr ft °F) [see Table 721.5.1(3)].

A_s = Cross-sectional area of steel column (square inches).

d_m = Density of the concrete or clay masonry unit (pounds per cubic foot).

p = Inner perimeter of concrete or clay masonry protection (inches) [see Figure 721.5.1(7)].

721.5.1.4.6 Equivalent concrete masonry thickness. For structural steel columns protected with concrete masonry, Table 721.5.1(5) gives the equivalent thickness of concrete masonry required for various fire-resistance ratings for typical column shapes. For structural steel columns protected with clay masonry, Table 721.5.1(6) gives the equivalent thickness of concrete masonry required for various fire-resistance ratings for typical column shapes.

721.5.2 Structural steel beams and girders. The fire-resistance ratings of steel beams and girders shall be based upon the size of the element and the type of protection provided in accordance with this section.

721.5.2.1 Determination of fire resistance. These procedures establish a basis for determining resistance of structural steel beams and girders which differ in size from that specified in approved fire-resistance-rated assemblies as a function of the thickness of fire-resistant material and the weight (W) and heated perimeter (D) of the beam or girder. As used in these sections, W is the average weight of a structural steel member in pounds per linear foot (plf). The heated perimeter, D, is the inside perimeter of the fire-resistant material in inches as illustrated in Figure 721.5.2.

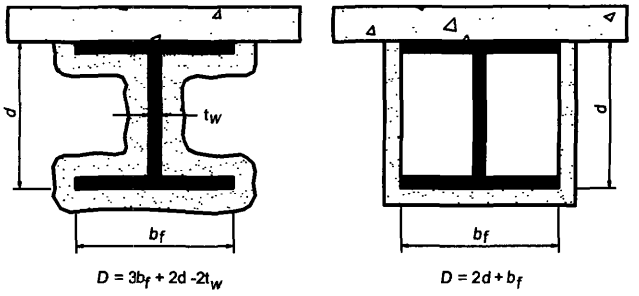


FIGURE 721.5.2
DETERMINATION OF THE HEATED PERIMETER OF STRUCTURAL STEEL BEAMS AND GIRDERS

721.5.2.1.1 Weight-to-heated perimeter. The weight-to-heated-perimeter ratios (W/D), for both contour and box fire-resistant protection profiles, for the wide flange shapes most often used as beams or girders are given in Table 721.5.1(4). For different shapes, the weight-to-heated-perimeter ratios (W/D) shall be determined in accordance with the definitions given in this section.

721.5.2.1.2 Beam and girder substitutions. Except as provided for in Section 721.5.2.2, structural steel beams in approved fire-resistance-rated assemblies shall be considered the minimum permissible size. Other beam or girder shapes shall be permitted to be substituted provided that the weight-to-heated-perimeter ratio (W/D) of the substitute beam is equal to or greater than that of the beam specified in the approved assembly.

721.5.2.2 Spray-applied fire-resistant materials. The provisions in this section apply to structural steel beams and girders protected with spray-applied fire-resistant materials. Larger or smaller beam and girder shapes shall be permitted to be substituted for beams specified in approved unrestrained or restrained fire-resistance-rated

TABLE 721.5.1(2)
PROPERTIES OF CONCRETE

PROPERTY	NORMAL-WEIGHT CONCRETE	STRUCTURAL LIGHTWEIGHT CONCRETE
Thermal conductivity (k_c)	0.95 Btu/hr ft °F	0.35 Btu/hr ft °F
Specific heat (c_c)	0.20 Btu/lb °F	0.20 Btu/lb °F
Density (P_c)	145 lb/ft^3	110 lb/ft^3
Equilibrium (free) moisture content (m) by volume	4%	5%

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb/ft^3 = 16.0185 kg/m^3, Btu/hr ft °F = 1.731 W/(m · K).

TABLE 721.5.1(3)
THERMAL CONDUCTIVITY OF CONCRETE OR CLAY MASONRY UNITS

DENSITY (d_m) OF UNITS (lb/ft^3)	THERMAL CONDUCTIVITY (K) OF UNITS (Btu/hr ft °F)
Concrete Masonry Units	
80	0.207
85	0.228
90	0.252
95	0.278
100	0.308
105	0.340
110	0.376
115	0.416
120	0.459
125	0.508
130	0.561
135	0.620
140	0.685
145	0.758
150	0.837
Clay Masonry Units	
120	1.25
130	2.25

For SI: 1 pound per cubic foot = 16.0185 kg/m^3, Btu per hour foot °F = 1.731 W/(m · K).

TABLE 721.5.1(4)
WEIGHT-TO-HEATED-PERIMETER RATIOS (*W/D*)
FOR TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W36 × 300	2.47	3.33	× 68	0.92	1.21
× 280	2.31	3.12	× 62	0.92	1.14
× 260	2.16	2.92	× 55	0.82	1.02
× 245	2.04	2.76			
× 230	1.92	2.61	W21 × 147	1.83	2.60
× 210	1.94	2.45	× 132	1.66	2.35
× 194	1.80	2.28	× 122	1.54	2.19
× 182	1.69	2.15	× 111	1.41	2.01
× 170	1.59	2.01	× 101	1.29	1.84
× 160	1.50	1.90	× 93	1.38	1.80
× 150	1.41	1.79	× 83	1.24	1.62
× 135	1.28	1.63	× 73	1.10	1.44
			× 68	1.03	1.35
W33 × 241	2.11	2.86	× 62	0.94	1.23
× 221	1.94	2.64	× 57	0.93	1.17
× 201	1.78	2.42	× 50	0.83	1.04
× 152	1.51	1.94	× 44	0.73	0.92
× 141	1.41	1.80			
× 130	1.31	1.67	W18 × 119	1.69	2.42
× 118	1.19	1.53	× 106	1.52	2.18
			× 97	1.39	2.01
W30 × 211	2.00	2.74	× 86	1.24	1.80
× 191	1.82	2.50	× 76	1.11	1.60
× 173	1.66	2.28	× 71	1.21	1.59
× 132	1.45	1.85	× 65	1.11	1.47
× 124	1.37	1.75	× 60	1.03	1.36
× 116	1.28	1.65	× 55	0.95	1.26
× 108	1.20	1.54	× 50	0.87	1.15
× 99	1.10	1.42	× 46	0.86	1.09
			× 40	0.75	0.96
W27 × 178	1.85	2.55	× 35	0.66	0.85
× 161	1.68	2.33			
× 146	1.53	2.12	W16 × 100	1.56	2.25
× 114	1.36	1.76	× 89	1.40	2.03
× 102	1.23	1.59	× 77	1.22	1.78
× 94	1.13	1.47	× 67	1.07	1.56
× 84	1.02	1.33	× 57	1.07	1.43
			× 50	0.94	1.26
			× 45	0.85	1.15
W24 × 162	1.85	2.57	× 40	0.76	1.03
× 146	1.68	2.34	× 36	0.69	0.93
× 131	1.52	2.12	× 31	0.65	0.83
× 117	1.36	1.91	× 26	0.55	0.70
× 104	1.22	1.71			
× 94	1.26	1.63	W14 × 132	1.83	3.00
× 84	1.13	1.47	× 120	1.67	2.75
× 76	1.03	1.34	× 109	1.53	2.52

(continued)

TABLE 721.5.1(4)—continued
WEIGHT-TO-HEATED-PERIMETER RATIOS (*W/D*)
FOR TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
× 99	1.39	2.31	× 30	0.79	1.12
× 90	1.27	2.11	× 26	0.69	0.98
× 82	1.41	2.12	× 22	0.59	0.84
× 74	1.28	1.93	× 19	0.59	0.78
× 68	1.19	1.78	× 17	0.54	0.70
× 61	1.07	1.61	× 15	0.48	0.63
× 53	1.03	1.48	× 12	0.38	0.51
× 48	0.94	1.35			
× 43	0.85	1.22	W8 × 67	1.61	2.55
× 38	0.79	1.09	× 58	1.41	2.26
× 34	0.71	0.98	× 48	1.18	1.91
× 30	0.63	0.87	× 40	1.00	1.63
× 26	0.61	0.79	× 35	0.88	1.44
× 22	0.52	0.68	× 31	0.79	1.29
			× 28	0.80	1.24
W12 × 87	1.44	2.34	× 24	0.69	1.07
× 79	1.32	2.14	× 21	0.66	0.96
× 72	1.20	1.97	× 18	0.57	0.84
× 65	1.09	1.79	× 15	0.54	0.74
× 58	1.08	1.69	× 13	0.47	0.65
× 53	0.99	1.55	× 10	0.37	0.51
× 50	1.04	1.54			
× 45	0.95	1.40	W6 × 25	0.82	1.33
× 40	0.85	1.25	× 20	0.67	1.09
× 35	0.79	1.11	× 16	0.66	0.96
× 30	0.69	0.96	× 15	0.51	0.83
× 26	0.60	0.84	× 12	0.51	0.75
× 22	0.61	0.77	× 9	0.39	0.57
× 19	0.53	0.67			
× 16	0.45	0.57	W5 × 19	0.76	1.24
× 14	0.40	0.50	× 16	0.65	1.07
W10 × 112	2.14	3.38	W4 × 13	0.65	1.05
× 100	1.93	3.07			
× 88	1.70	2.75			
× 77	1.52	2.45			
× 68	1.35	2.20			
× 60	1.20	1.97			
× 54	1.09	1.79			
× 49	0.99	1.64			
× 45	1.03	1.59			
× 39	0.94	1.40			
× 33	0.77	1.20			

For SI: Pounds per linear foot per inch = 0.059 kg/m/mm.

TABLE 721.5.1(5)
FIRE RESISTANCE OF CONCRETE MASONRY PROTECTED STEEL COLUMNS

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, T_e (inches)				COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1-hour	2-hour	3-hour	4-hour			1-hour	2-hour	3-hour	4-hour
W14 × 82	80	0.74	1.61	2.36	3.04	W10 × 68	80	0.72	1.58	2.33	3.01
	100	0.89	1.85	2.67	3.40		100	0.87	1.83	2.65	3.38
	110	0.96	1.97	2.81	3.57		110	0.94	1.95	2.79	3.55
	120	1.03	2.08	2.95	3.73		120	1.01	2.06	2.94	3.72
W14 × 68	80	0.83	1.70	2.45	3.13	W10 × 54	80	0.88	1.76	2.53	3.21
	100	0.99	1.95	2.76	3.49		100	1.04	2.01	2.83	3.57
	110	1.06	2.06	2.91	3.66		110	1.11	2.12	2.98	3.73
	120	1.14	2.18	3.05	3.82		120	1.19	2.24	3.12	3.90
W14 × 53	80	0.91	1.81	2.58	3.27	W10 × 45	80	0.92	1.83	2.60	3.30
	100	1.07	2.05	2.88	3.62		100	1.08	2.07	2.90	3.64
	110	1.15	2.17	3.02	3.78		110	1.16	2.18	3.04	3.80
	120	1.22	2.28	3.16	3.94		120	1.23	2.29	3.18	3.96
W14 × 43	80	1.01	1.93	2.71	3.41	W10 × 33	80	1.06	2.00	2.79	3.49
	100	1.17	2.17	3.00	3.74		100	1.22	2.23	3.07	3.81
	110	1.25	2.28	3.14	3.90		110	1.30	2.34	3.20	3.96
	120	1.32	2.38	3.27	4.05		120	1.37	2.44	3.33	4.12
W12 × 72	80	0.81	1.66	2.41	3.09	W8 × 40	80	0.94	1.85	2.63	3.33
	100	0.91	1.88	2.70	3.43		100	1.10	2.10	2.93	3.67
	110	0.99	1.99	2.84	3.60		110	1.18	2.21	3.07	3.83
	120	1.06	2.10	2.98	3.76		120	1.25	2.32	3.20	3.99
W12 × 58	80	0.88	1.76	2.52	3.21	W8 × 31	80	1.06	2.00	2.78	3.49
	100	1.04	2.01	2.83	3.56		100	1.22	2.23	3.07	3.81
	110	1.11	2.12	2.97	3.73		110	1.29	2.33	3.20	3.97
	120	1.19	2.23	3.11	3.89		120	1.36	2.44	3.33	4.12
W12 × 50	80	0.91	1.81	2.58	3.27	W8 × 24	80	1.14	2.09	2.89	3.59
	100	1.07	2.05	2.88	3.62		100	1.29	2.31	3.16	3.90
	110	1.15	2.17	3.02	3.78		110	1.36	2.42	3.28	4.05
	120	1.22	2.28	3.16	3.94		120	1.43	2.52	3.41	4.20
W12 × 40	80	1.01	1.94	2.72	3.41	W8 × 18	110	1.22	2.20	3.01	3.72
	100	1.17	2.17	3.01	3.75		100	1.36	2.40	3.25	4.01
	110	1.25	2.28	3.14	3.90		110	1.42	2.50	3.37	4.14
	120	1.32	2.39	3.27	4.06		120	1.48	2.59	3.49	4.28

(continued)

TABLE 721.5.1(5)—continued
FIRE RESISTANCE OF CONCRETE MASONRY PROTECTED STEEL COLUMNS

NOMINAL TUBE SIZE (inches)	CONCRETE MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, T_e (inches)				NOMINAL PIPE SIZE (inches)	CONCRETE MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1-hour	2-hour	3-hour	4-hour			1-hour	2-hour	3-hour	4-hour
$4 \times 4 \times {}^1/_2$ wall thickness	80	0.93	1.90	2.71	3.43	4 double extra strong 0.674 wall thickness	80	0.80	1.75	2.56	3.28
	100	1.08	2.13	2.99	3.76		100	0.95	1.99	2.85	3.62
	110	1.16	2.24	3.13	3.91		110	1.02	2.10	2.99	3.78
	120	1.22	2.34	3.26	4.06		120	1.09	2.20	3.12	3.93
$4 \times 4 \times {}^3/_8$ wall thickness	80	1.05	2.03	2.84	3.57	4 extra strong 0.337 wall thickness	80	1.12	2.11	2.93	3.65
	100	1.20	2.25	3.11	3.88		100	1.26	2.32	3.19	3.95
	110	1.27	2.35	3.24	4.02		110	1.33	2.42	3.31	4.09
	120	1.34	2.45	3.37	4.17		120	1.40	2.52	3.43	4.23
$4 \times 4 \times {}^1/_4$ wall thickness	80	1.21	2.20	3.01	3.73	4 standard 0.237 wall thickness	80	1.26	2.25	3.07	3.79
	100	1.35	2.40	3.26	4.02		100	1.40	2.45	3.31	4.07
	110	1.41	2.50	3.38	4.16		110	1.46	2.55	3.43	4.21
	120	1.48	2.59	3.50	4.30		120	1.53	2.64	3.54	4.34
$6 \times 6 \times {}^1/_2$ wall thickness	80	0.82	1.75	2.54	3.25	5 double extra strong 0.750 wall thickness	80	0.70	1.61	2.40	3.12
	100	0.98	1.99	2.84	3.59		100	0.85	1.86	2.71	3.47
	110	1.05	2.10	2.98	3.75		110	0.91	1.97	2.85	3.63
	120	1.12	2.21	3.11	3.91		120	0.98	2.02	2.99	3.79
$6 \times 6 \times {}^3/_8$ wall thickness	80	0.96	1.91	2.71	3.42	5 extra strong 0.375 wall thickness	80	1.04	2.01	2.83	3.54
	100	1.12	2.14	3.00	3.75		100	1.19	2.23	3.09	3.85
	110	1.19	2.25	3.13	3.90		110	1.26	2.34	3.22	4.00
	120	1.26	2.35	3.26	4.05		120	1.32	2.44	3.34	4.14
$6 \times 6 \times {}^1/_4$ wall thickness	80	1.14	2.11	2.92	3.63	5 standard 0.258 wall thickness	80	1.20	2.19	3.00	3.72
	100	1.29	2.32	3.18	3.93		100	1.34	2.39	3.25	4.00
	110	1.36	2.43	3.30	4.08		110	1.41	2.49	3.37	4.14
	120	1.42	2.52	3.43	4.22		120	1.47	2.58	3.49	4.28
$8 \times 8 \times {}^1/_2$ wall thickness	80	0.77	1.66	2.44	3.13	6 double extra strong 0.864 wall thickness	80	0.59	1.46	2.23	2.92
	100	0.92	1.91	2.75	3.49		100	0.73	1.71	2.54	3.29
	110	1.00	2.02	2.89	3.66		110	0.80	1.82	2.69	3.47
	120	1.07	2.14	3.03	3.82		120	0.86	1.93	2.83	3.63
$8 \times 8 \times {}^3/_8$ wall thickness	80	0.91	1.84	2.63	3.33	6 extra strong 0.432 wall thickness	80	0.94	1.90	2.70	3.42
	100	1.07	2.08	2.92	3.67		100	1.10	2.13	2.98	3.74
	110	1.14	2.19	3.06	3.83		110	1.17	2.23	3.11	3.89
	120	1.21	2.29	3.19	3.98		120	1.24	2.34	3.24	4.04
$8 \times 8 \times {}^1/_4$ wall thickness	80	1.10	2.06	2.86	3.57	6 standard 0.280 wall thickness	80	1.14	2.12	2.93	3.64
	100	1.25	2.28	3.13	3.87		100	1.29	2.33	3.19	3.94
	110	1.32	2.38	3.25	4.02		110	1.36	2.43	3.31	4.08
	120	1.39	2.48	3.38	4.17		120	1.42	2.53	3.43	4.22

For SI: 1 inch = 25.4 mm, 1 pound per cubic feet = 16.02 kg/m^3.
Note: Tabulated values assume 1-inch air gap between masonry and steel section.

TABLE 721.5.1(6)
FIRE RESISTANCE OF CLAY MASONRY PROTECTED STEEL COLUMNS

COLUMN SIZE	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1-hour	2-hour	3-hour	4-hour
W14 × 82	120	1.23	2.42	3.41	4.29
	130	1.40	2.70	3.78	4.74
W14 × 68	120	1.34	2.54	3.54	4.43
	130	1.51	2.82	3.91	4.87
W14 × 53	120	1.43	2.65	3.65	4.54
	130	1.61	2.93	4.02	4.98
W14 × 43	120	1.54	2.76	3.77	4.66
	130	1.72	3.04	4.13	5.09
W12 × 72	120	1.32	2.52	3.51	4.40
	130	1.50	2.80	3.88	4.84
W12 × 58	120	1.40	2.61	3.61	4.50
	130	1.57	2.89	3.98	4.94
W12 × 50	120	1.43	2.65	3.66	4.55
	130	1.61	2.93	4.02	4.99
W12 × 40	120	1.54	2.77	3.78	4.67
	130	1.72	3.05	4.14	5.10
W10 × 68	120	1.27	2.46	3.26	4.35
	130	1.44	2.75	3.83	4.80
W10 × 54	120	1.40	2.61	3.62	4.51
	130	1.58	2.89	3.98	4.95
W10 × 45	120	1.44	2.66	3.67	4.57
	130	1.62	2.95	4.04	5.01
W10 × 33	120	1.59	2.82	3.84	4.73
	130	1.77	3.10	4.20	5.13
W8 × 40	120	1.47	2.70	3.71	4.61
	130	1.65	2.98	4.08	5.04
W8 × 31	120	1.59	2.82	3.84	4.73
	130	1.77	3.10	4.20	5.17
W8 × 24	120	1.66	2.90	3.92	4.82
	130	1.84	3.18	4.28	5.25
W8 × 18	120	1.75	3.00	4.01	4.91
	130	1.93	3.27	4.37	5.34

STEEL TUBING

NOMINAL TUBE SIZE (inches)	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1-hour	2-hour	3-hour	4-hour
4 × 4 × 1/2 wall thickness	120	1.44	2.72	3.76	4.68
	130	1.62	3.00	4.12	5.11
4 × 4 × 3/8 wall thickness	120	1.56	2.84	3.88	4.78
	130	1.74	3.12	4.23	5.21
4 × 4 × 1/4 wall thickness	120	1.72	2.99	4.02	4.92
	130	1.89	3.26	4.37	5.34
6 × 6 × 1/2 wall thickness	120	1.33	2.58	3.62	4.52
	130	1.50	2.86	3.98	4.96
6 × 6 × 3/8 wall thickness	120	1.48	2.74	3.76	4.67
	130	1.65	3.01	4.13	5.10
6 × 6 × 1/4 wall thickness	120	1.66	2.91	3.94	4.84
	130	1.83	3.19	4.30	5.27
8 × 8 × 1/2 wall thickness	120	1.27	2.50	3.52	4.42
	130	1.44	2.78	3.89	4.86
8 × 8 × 3/8 wall thickness	120	1.43	2.67	3.69	4.59
	130	1.60	2.95	4.05	5.02
8 × 8 × 1/4 wall thickness	120	1.62	2.87	3.89	4.78
	130	1.79	3.14	4.24	5.21

STEEL PIPE

NOMINAL PIPE SIZE (inches)	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1-hour	2-hour	3-hour	4-hour
4 double extra strong 0.674 wall thickness	120	1.26	2.55	3.60	4.52
	130	1.42	2.82	3.96	4.95
4 extra strong 0.337 wall thickness	120	1.60	2.89	3.92	4.83
	130	1.77	3.16	4.28	5.25
4 standard 0.237 wall thickness	120	1.74	3.02	4.05	4.95
	130	1.92	3.29	4.40	5.37
5 double extra strong 0.750 wall thickness	120	1.17	2.44	3.48	4.40
	130	1.33	2.72	3.84	4.83
5 extra strong 0.375 wall thickness	120	1.55	2.82	3.85	4.76
	130	1.72	3.09	4.21	5.18
5 standard 0.258 wall thickness	120	1.71	2.97	4.00	4.90
	130	1.88	3.24	4.35	5.32
6 double extra strong 0.864 wall thickness	120	1.04	2.28	3.32	4.23
	130	1.19	2.60	3.68	4.67
6 extra strong 0.432 wall thickness	120	1.45	2.71	3.75	4.65
	130	1.62	2.99	4.10	5.08
6 standard 0.280 wall thickness	120	1.65	2.91	3.94	4.84
	130	1.82	3.19	4.30	5.27

TABLE 721.5.1(7)
MINIMUM COVER (inch) FOR STEEL COLUMNS ENCASED IN NORMAL-WEIGHT CONCRETE[a]
[FIGURE 721.5.1(6)(c)]

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1 1/2	2	3	4
W14 × 233	1	1	1	1 1/2	2
× 176					2 1/2
× 132				2	
× 90			1 1/2		3
× 61					
× 48		1 1/2		2 1/2	
× 43					
W12 × 152	1	1	1	2	2 1/2
× 96					3
× 65			1 1/2		
× 50		1 1/2		2 1/2	
× 40					
W10 × 88	1	1 1/2	1 1/2	2	3
× 49	1			2 1/2	3 1/2
× 45					
× 39			2		
× 33					
W8 × 67	1	1	1 1/2	2 1/2	3
× 58					3 1/2
× 48		1 1/2	2	3	4
× 31					
× 21					
× 18					
W6 × 25	1	2	2	3	3 1/2
× 20					4
× 16					
× 15					
× 9	1 1/2	2	2 1/2	3 1/2	

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of normal-weight concrete given in Table 721.5.1(2).

TABLE 721.5.1(8)
MINIMUM COVER (inch) FOR STEEL COLUMNS ENCASED IN STRUCTURAL LIGHTWEIGHT CONCRETE[a]
[FIGURE 721.5.1(6)(c)]

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (HOURS)				
	1	1 1/2	2	3	4
W14 × 233	1	1	1	1	1 1/2
× 193				1 1/2	2
× 74					
× 61					2 1/2
× 43			1 1/2	2	
W12 × 65	1	1	1	1 1/2	2
× 53				2	2 1/2
× 40			1 1/2		
W10 × 112	1	1	1	1 1/2	2
× 88					3
× 60			1 1/2	2	
× 33					
W8 × 35	1	1	1 1/2	2	3
× 28					
× 24					
× 18		1 1/2		2 1/2	

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of structural lightweight concrete given in Table 721.5.1(2).

TABLE 721.5.1(9)
MINIMUM COVER (inch) FOR STEEL COLUMNS IN NORMAL-WEIGHT PRECAST COVERS[a]
[FIGURE 721.5.1(6)(a)]

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1 1/2	2	3	4
W14 × 233	1 1/2	1 1/2	1 1/2	2 1/2	3
× 211					3 1/2
× 176			2	3	
× 145		1 1/2			
× 109					
× 99					4
× 61					
× 43		2	2 1/2	3 1/2	4 1/2
W12 × 190	1 1/2	1 1/2	1 1/2	2 1/2	3 1/2
× 152			2	3	4
× 120					
× 96					
× 87					
× 58					
× 40		2	2 1/2	3 1/2	4 1/2
W10 × 112	1 1/2	1 1/2	2	3	3 1/2
× 88					4
× 77		2	2 1/2	3 1/2	
× 54					
× 33					4 1/2
W8 × 67	1 1/2	1 1/2	2	3	4
× 58		2	2 1/2	3 1/2	
× 48					
× 28		2 1/2	3	4	4 1/2
× 21					
× 18					
W6 × 25	1 1/2	2	2 1/2	3 1/2	4 1/2
× 20		2 1/2	3	4	
× 16					
× 12	2				
× 9					5

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of normal-weight concrete given in Table 721.5.1(2).

TABLE 721.5.1(10)
MINIMUM COVER (inch) FOR STEEL COLUMNS IN STRUCTURAL LIGHTWEIGHT PRECAST COVERS[a]
[FIGURE 721.5.1(6)(a)]

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1 1/2	2	3	4
W14 × 233	1 1/2	1 1/2	1 1/2	2	2 1/2
× 176					3
× 145				2 1/2	
× 132					
× 109					
× 99			2		
× 68				3	3 1/2
× 43					
W12 × 190	1 1/2	1 1/2	1 1/2	2	2 1/2
× 152					3
× 136				2 1/2	
× 106					
× 96					
× 87					
× 65			2		
× 40				3	3 1/2
W10 × 112	1 1/2	1 1/2	1 1/2	2	3
× 100					
× 88				2 1/2	
× 77			2		
× 60				3	3 1/2
× 39					
× 33		2			
W8 × 67	1 1/2	1 1/2	1 1/2	2 1/2	3
× 48				3	3 1/2
× 35			2		
× 28					
× 18		2	2 1/2		4
W6 × 25	1 1/2	2	2	3	3 1/2
× 15					4
× 9			2 1/2	3 1/2	

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of structural lightweight concrete given in Table 721.5.1(2).

assemblies, provided the thickness of the fire-resistant material is adjusted in accordance with the following expression:

$$h_2 = h_1\left[\left(W_1 / D_1\right) + 0.60\right] / \left[\left(W_2 / D_2\right) + 0.60\right]$$

(Equation 7-17)

where:

h = Thickness of spray-applied fire-resistant material in inches.

W = Weight of the structural steel beam or girder in pounds per linear foot.

D = Heated perimeter of the structural steel beam in inches.

Subscript 1 refers to the beam and fire-resistant material thickness in the approved assembly.

Subscript 2 refers to the substitute beam or girder and the required thickness of fire-resistant material.

The fire resistance of structural steel beams and girders protected with intumescent or mastic fire-resistant coatings shall be determined on the basis of fire-resistance tests in accordance with Section 703.2.

721.5.2.2.1 Minimum thickness. The use of Equation 7-17 is subject to the following conditions:

1. The weight-to-heated-perimeter ratio for the substitute beam or girder (W_2/D_2) shall not be less than 0.37.
2. The thickness of fire protection materials calculated for the substitute beam or girder (T_1) shall not be less than $^3/_8$ inch (9.5 mm).
3. The unrestrained or restrained beam rating shall not be less than 1 hour.
4. When used to adjust the material thickness for a restrained beam, the use of this procedure is limited to steel sections classified as compact in accordance with the AISC *Specification for Structural Steel Buildings*, (AISC 360-05).

721.5.2.3 Structural steel trusses. The fire resistance of structural steel trusses protected with fire-resistant materials spray-applied to each of the individual truss elements shall be permitted to be determined in accordance with this section. The thickness of the fire-resistant material shall be determined in accordance with Section 721.5.1.3. The weight-to-heated-perimeter ratio (W/D) of truss elements that can be simultaneously exposed to fire on all sides shall be determined on the same basis as columns, as specified in Section 721.5.1.1. The weight-to-heated-perimeter ratio (W/D) of truss elements that directly support floor or roof construction shall be determined on the same basis as beams and girders, as specified in Section 721.5.2.1.

The fire resistance of structural steel trusses protected with intumescent or mastic fire-resistant coatings shall be determined on the basis of fire-resistance tests in accordance with Section 703.2.

721.6 Wood assemblies. The provisions of this section contain procedures by which the fire-resistance ratings of wood assemblies are established by calculations.

721.6.1 General. This section contains procedures for calculating the fire-resistance ratings of walls, floor/ceiling and roof/ceiling assemblies based in part on the standard method of testing referenced in Section 703.2.

721.6.1.1 Maximum fire-resistance rating. Fire-resistance ratings calculated using the procedures in this section shall be used only for 1-hour rated assemblies.

721.6.1.2 Dissimilar membranes. Where dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.

721.6.2 Walls, floors and roofs. These procedures apply to both load-bearing and nonload-bearing assemblies.

721.6.2.1 Fire-resistance rating of wood frame assemblies. The fire-resistance rating of a wood frame assembly is equal to the sum of the time assigned to the membrane on the fire-exposed side, the time assigned to the framing members and the time assigned for additional contribution by other protective measures such as insulation. The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly.

TABLE 721.6.2(1)
TIME ASSIGNED TO WALLBOARD MEMBRANES[a,b,c,d]

DESCRIPTION OF FINISH	TIME[e] (minutes)
$^3/_8$-inch wood structural panel bonded with exterior glue	5
$^{15}/_{32}$-inch wood structural panel bonded with exterior glue	10
$^{19}/_{32}$-inch wood structural panel bonded with exterior glue	15
$^3/_8$-inch gypsum wallboard	10
$^1/_2$-inch gypsum wallboard	15
$^5/_8$-inch gypsum wallboard	30
$^1/_2$-inch Type X gypsum wallboard	25
$^5/_8$-inch Type X gypsum wallboard	40
Double $^3/_8$-inch gypsum wallboard	25
$^1/_2$- + $^3/_8$-inch gypsum wallboard	35
Double $^1/_2$-inch gypsum wallboard	40

For SI: 1 inch = 25.4 mm.

a. These values apply only when membranes are installed on framing members which are spaced 16 inches o.c.

b. Gypsum wallboard installed over framing or furring shall be installed so that all edges are supported, except $^5/_8$-inch Type X gypsum wallboard shall be permitted to be installed horizontally with the horizontal joints staggered 24 inches each side and unsupported but finished.

c. On wood frame floor/ceiling or roof/ceiling assemblies, gypsum board shall be installed with the long dimension perpendicular to framing members and shall have all joints finished.

d. The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly. When dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.

e. The time assigned is not a finished rating.

721.6.2.2 Time assigned to membranes. Table 721.6.2(1) indicates the time assigned to membranes on the fire-exposed side.

721.6.2.3 Exterior walls. For an exterior wall having more than 5 feet (1524 mm) of horizontal separation, the wall is assigned a rating dependent on the interior membrane and the framing as described in Tables 721.6.2(1) and 721.6.2(2). The membrane on the outside of the nonfire-exposed side of exterior walls having more than 5 feet (1524 mm) of horizontal separation may consist of sheathing, sheathing paper, and siding as described in Table 721.6.2(3).

721.6.2.4 Floors and roofs. In the case of a floor or roof, the standard test provides only for testing for fire exposure from below. Except as noted in Section 703.3, Item 5, floor or roof assemblies of wood framing shall have an upper membrane consisting of a subfloor and finished floor conforming to Table 721.6.2(4) or any other membrane that has a contribution to fire resistance of at least 15 minutes in Table 721.6.2(1).

721.6.2.5 Additional protection. Table 721.6.2(5) indicates the time increments to be added to the fire resistance where glass fiber, rockwool, slag mineral wool, or cellulose insulation is incorporated in the assembly.

721.6.2.6 Fastening. Fastening of wood frame assemblies and the fastening of membranes to the wood framing members shall be done in accordance with Chapter 23.

721.6.3 Design of fire-resistant exposed wood members. The fire-resistance rating, in minutes, of timber beams and columns with a minimum nominal dimension of 6 inches (152 mm) is equal to:

TABLE 721.6.2(1)
TIME ASSIGNED TO WALLBOARD MEMBRANES[a,b,c,d]

DESCRIPTION OF FINISH	TIME[e] (minutes)
$^3/_8$-inch wood structural panel bonded with exterior glue	5
$^{15}/_{32}$-inch wood structural panel bonded with exterior glue	10
$^{19}/_{32}$-inch wood structural panel bonded with exterior glue	15
$^3/_8$-inch gypsum wallboard	10
$^1/_2$-inch gypsum wallboard	15
$^5/_8$-inch gypsum wallboard	30
$^1/_2$-inch Type X gypsum wallboard	25
$^5/_8$-inch Type X gypsum wallboard	40
Double $^3/_8$-inch gypsum wallboard	25
$^1/_2$- + $^3/_8$-inch gypsum wallboard	35
Double $^1/_2$-inch gypsum wallboard	40

For SI: 1 inch = 25.4 mm.

a. These values apply only when membranes are installed on framing members which are spaced 16 inches o.c.

b. Gypsum wallboard installed over framing or furring shall be installed so that all edges are supported, except $^5/_8$-inch Type X gypsum wallboard shall be permitted to be installed horizontally with the horizontal joints staggered 24 inches each side and unsupported but finished.

c. On wood frame floor/ceiling or roof/ceiling assemblies, gypsum board shall be installed with the long dimension perpendicular to framing members and shall have all joints finished.

d. The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly. When dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.

e. The time assigned is not a finished rating.

TABLE 721.6.2(2)
TIME ASSIGNED FOR CONTRIBUTION OF WOOD FRAME [a,b,c]

DESCRIPTION	TIME ASSIGNED TO FRAME (minutes)
Wood studs 16 inches o.c.	20
Wood floor and roof joists 16 inches o.c.	10

For SI: 1 inch = 25.4 mm.

a. This table does not apply to studs or joists spaced more than 16 inches o.c.

b. All studs shall be nominal 2 × 4 and all joists shall have a nominal thickness of at least 2 inches.

c. Allowable spans for joists shall be determined in accordance with Sections 2308.8, 2308.10.2 and 2308.10.3.

TABLE 721.6.2(3)
MEMBRANE[a] ON EXTERIOR FACE OF WOOD STUD WALLS

SHEATHING	PAPER	EXTERIOR FINISH
$^5/_8$-inch T & G lumber	Sheathing paper	Lumber siding
$^5/_{16}$-inch exterior glue wood structural panel		Wood shingles and shakes
$^1/_2$-inch gypsum wallboard		$^1/_4$-inch wood structural panels—exterior type
$^5/_8$-inch gypsum wallboard		$^1/_4$-inch hardboard
$^1/_2$-inch fiberboard		Metal siding
		Stucco on metal lath
		Masonry veneer
None	—	$^3/_8$-inch exterior-grade wood structural panels

For SI: 1 pound/cubic foot = 16.0185 kg/m^2.

a. Any combination of sheathing, paper and exterior finish is permitted.

TABLE 721.6.2(4)
FLOORING OR ROOFING OVER WOOD FRAMING[a]

ASSEMBLY	STRUCTURAL MEMBERS	SUBFLOOR OR ROOF DECK	FINISHED FLOORING OR ROOFING
Floor	Wood	$^{15}/_{32}$-inch wood structural panels or $^{11}/_{16}$ inch T & G softwood	Hardwood or softwood flooring on building paper resilient flooring, parquet floor felted-synthetic fiber floor coverings, carpeting, or ceramic tile on $^{3}/_{8}$-inch-thick panel-type underlay Ceramic tile on $1^{1}/_{4}$-inch mortar bed
Roof	Wood	$^{15}/_{32}$-inch wood structural panels or $^{11}/_{16}$ inch T & G softwood	Finished roofing material with or without insulation

For SI: 1 inch = 25.4 mm.

a. This table applies only to wood joist construction. It is not applicable to wood truss construction.

TABLE 721.6.2(5)
TIME ASSIGNED FOR ADDITIONAL PROTECTION

DESCRIPTION OF ADDITIONAL PROTECTION	FIRE RESISTANCE (minutes)
Add to the fire-resistance rating of wood stud walls if the spaces between the studs are completely filled with glass fiber mineral wool batts weighing not less than 2 pounds per cubic foot (0.6 pound per square foot of wall surface) or rockwool or slag material wool batts weighing not less than 3.3 pounds per cubic foot (1 pound per square foot of wall surface), or cellulose insulation having a nominal density not less than 2.6 pounds per cubic foot.	15

For SI: 1 pound/cubic foot = 16.0185 kg/m^3.

Beams: $2.54Zb\ [4 - 2(b/d)]$ for beams which may be exposed to fire on four sides.

(Equation 7-18)

$2.54Zb\ [4 - (b/d)]$ for beams which may be exposed to fire on three sides.

(Equation 7-19)

Columns: $2.54Zd\ [3 - (d/b)]$ for columns which may be exposed to fire on four sides

(Equation 7-20)

$2.54Zd\ [3 - (d/2b)]$ for columns which may be exposed to fire on three sides.

(Equation 7-21)

where:

b = The breadth (width) of a beam or larger side of a column before exposure to fire (inches).

d = The depth of a beam or smaller side of a column before exposure to fire (inches).

Z = Load factor, based on Figure 721.6.3(1).

721.6.3.1 Equation 7-21. Equation 7-21 applies only where the unexposed face represents the smaller side of the column. If a column is recessed into a wall, its full dimension shall be used for the purpose of these calculations.

721.6.3.2 Allowable loads. Allowable loads on beams and columns are determined using design values given in AF&PA NDS.

721.6.3.3 Fastener protection. Where minimum 1-hour fire resistance is required, connectors and fasteners shall be protected from fire exposure by $1^{1}/_{2}$ inches (38 mm) of wood, or other approved covering or coating for a 1-hour rating. Typical details for commonly used fasteners and connectors are shown in AITC Technical Note 7.

721.6.3.4 Minimum size. Wood members are limited to dimensions of 6 inches (152 mm) nominal or greater. Glued-laminated timber beams utilize standard laminating combinations except that a core lamination is removed. The tension zone is moved inward and the equivalent of an extra nominal 2-inch-thick (51 mm) outer tension lamination is added.

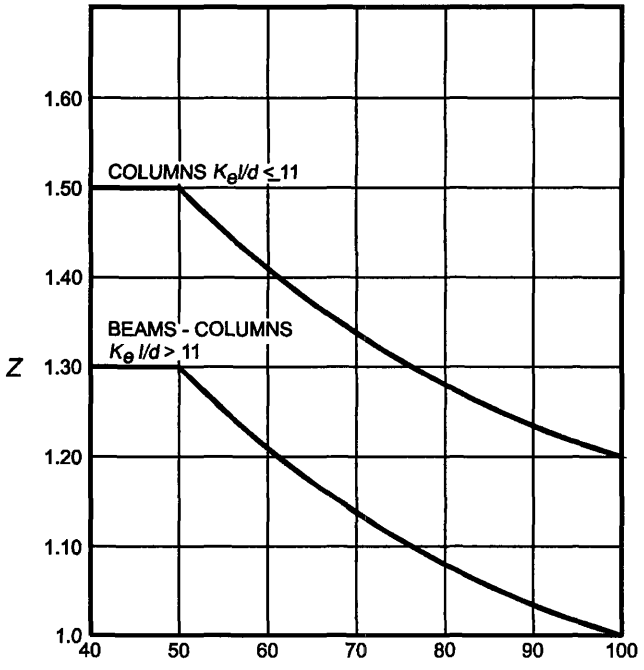


FIGURE 721.6.3(1)
LOAD FIGURE

K_e = The effective length factor as noted in Figure 721.6.3(2).
l = The unsupported length of columns (inches).

BUCKLING MODES						
THEORETICAL K_e VALUE	0.5	0.7	1.0	1.0	2.0	2.0
RECOMMENDED DESIGN K_e WHEN IDEAL CONDITIONS APPROXIMATED	0.65	0.80	1.2	1.0	2.10	2.4
END CONDITION CODE	ROTATION FIXED, TRANSLATION FIXED ROTATION FREE, TRANSLATION FIXED ROTATION FIXED, TRANSLATION FREE ROTATION FREE, TRANSLATION FREE					

FIGURE 721.6.3(2)
EFFECTIVE LENGTH FACTORS

CHAPTER 8
INTERIOR FINISHES

SECTION 801
GENERAL

801.1 Scope. Provisions of this chapter shall govern the use of materials used as interior finishes, trim and decorative materials.

801.1.1 Interior finishes. These provisions shall limit the allowable flame spread and smoke development based on location and occupancy classification.

Exceptions:

1. Materials having a thickness less than 0.036 inch (0.9 mm) applied directly to the surface of walls or ceilings.
2. Exposed portions of structural members complying with the requirements for buildings of Type IV construction in Section 602.4 shall not be subject to interior finish requirements.

[F] 801.1.2 Decorative materials and trim. Decorative materials and trim shall be restricted by combustibility and the flame propagation performance criteria of NFPA 701, in accordance with Section 806.

801.1.3 Applicability. For buildings in flood hazard areas as established in Section 1612.3, interior finishes, trim and decorative materials below the design flood elevation shall be flood-damage-resistant materials.

801.2 Application. Combustible materials shall be permitted to be used as finish for walls, ceilings, floors and other interior surfaces of buildings.

801.2.1 Windows. Show windows in the exterior walls of the first story above grade shall be permitted to be of wood or of unprotected metal framing.

801.2.2 Foam plastics. Foam plastics shall not be used as interior finish or trim except as provided in Section 2603.9 or 2604. This section shall apply both to exposed foam plastics and to foam plastics used in conjunction with a textile or vinyl facing or cover.

SECTION 802
DEFINITIONS

802.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

EXPANDED VINYL WALL COVERING. Wall covering consisting of a woven textile backing, an expanded vinyl base coat layer and a nonexpanded vinyl skin coat. The expanded base coat layer is a homogeneous vinyl layer that contains a blowing agent. During processing, the blowing agent decomposes, causing this layer to expand by forming closed cells. The total thickness of the wall covering is approximately 0.055 inch to 0.070 inch (1.4 mm to 1.78 mm).

FLAME SPREAD. The propagation of flame over a surface.

FLAME SPREAD INDEX. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E 84.

INTERIOR FINISH. Interior finish includes interior wall and ceiling finish and interior floor finish.

INTERIOR FLOOR FINISH. The exposed floor surfaces of buildings including coverings applied over a finished floor or stair, including risers.

INTERIOR WALL AND CEILING FINISH. The exposed interior surfaces of buildings, including but not limited to: fixed or movable walls and partitions; toilet room privacy partitions; columns; ceilings; and interior wainscoting, paneling or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including trim.

SMOKE-DEVELOPED INDEX. A comparative measure, expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material tested in accordance with ASTM E 84.

TRIM. Picture molds, chair rails, baseboards, handrails, door and window frames and similar decorative or protective materials used in fixed applications.

SECTION 803
WALL AND CEILING FINISHES

803.1 General. Interior wall and ceiling finishes shall be classified in accordance with ASTM E 84. Such interior finish materials shall be grouped in the following classes in accordance with their flame spread and smoke-developed indexes.

Class A: Flame spread 0-25; smoke-developed 0-450.

Class B: Flame spread 26-75; smoke-developed 0-450.

Class C: Flame spread 76-200; smoke-developed 0-450.

Exception: Materials, other than textiles, tested in accordance with Section 803.2.

803.2 Interior wall or ceiling finishes other than textiles. Interior wall or ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Finishes tested in accordance with NFPA 286 shall comply with Section 803.2.1.

803.2.1 Acceptance criteria. During the 40 kW exposure, the interior finish shall comply with Item 1. During the 160 kW exposure, the interior finish shall comply with Item 2. During the entire test, the interior finish shall comply with Items 3 and 4.

1. During the 40 kW exposure, flames shall not spread to the ceiling.

2. During the 160 kW exposure, the interior finish shall comply with the following:
    2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling.
    2.2. Flashover, as defined in NFPA 286, shall not occur.
3. The peak rate of heat release throughout the NFPA 286 test shall not exceed 800 kW.
4. The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m^2.

803.3 Stability. Interior finish materials regulated by this chapter shall be applied or otherwise fastened in such a manner that such materials will not readily become detached where subjected to room temperatures of 200°F (93°C) for not less than 30 minutes.

803.4 Application. Where these materials are applied on walls, ceilings or structural elements required to have a fire-resistance rating or to be of noncombustible construction, they shall comply with the provisions of this section.

803.4.1 Direct attachment and furred construction. Where walls and ceilings are required by any provision in this code to be of fire-resistance-rated or noncombustible construction, the interior finish material shall be applied directly against such construction or to furring strips not exceeding 1.75 inches (44 mm) applied directly against such surfaces. The intervening spaces between such furring strips shall be filled with inorganic or Class A material or shall be fireblocked at a maximum of 8 feet (2438 mm) in any direction in accordance with Section 717.

803.4.2 Set-out construction. Where walls and ceilings are required to be of fire-resistance-rated or noncombustible construction and walls are set out or ceilings are dropped distances greater than specified in Section 803.4.1, Class A finish materials shall be used except where interior finish materials are protected on both sides by an automatic sprinkler system or attached to noncombustible backing or furring strips installed as specified in Section 803.4.1. The hangers and assembly members of such dropped ceilings that are below the main ceiling line shall be of noncombustible materials, except that in Type III and V construction, fire-retardant-treated wood shall be permitted. The construction of each set-out wall shall be of fire-resistance-rated construction as required elsewhere in this code.

803.4.3 Heavy timber construction. Wall and ceiling finishes of all classes as permitted in this chapter that are installed directly against the wood decking or planking of Type IV construction or to wood furring strips applied directly to the wood decking or planking shall be fireblocked as specified in Section 803.4.1.

803.4.4 Materials. An interior wall or ceiling finish that is not more than 0.25 inch (6.4 mm) thick shall be applied directly against a noncombustible backing.

Exceptions:

1. Class A materials.
2. Materials where the qualifying tests were made with the material suspended or furred out from the noncombustible backing.

803.5 Interior finish requirements based on group. Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 803.5 for the group and location designated. Interior wall and ceiling finish materials, other than textiles, tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.2.1, shall be permitted to be used where a Class A classification in accordance with ASTM E 84 is required.

803.6 Textiles. Where used as interior wall or ceiling finish materials, textiles, including materials having woven or nonwoven, napped, tufted, looped or similar surface and carpet and similar textile materials, shall comply with the requirements of Section 803.6.1, 803.6.2 or 803.6.3.

803.6.1 Surface burning characteristic test. Textile wall and ceiling coverings shall have a Class A flame spread index in accordance with ASTM E 84 and be protected by automatic sprinklers installed in accordance with Section 903.3.1.1 or 903.3.1.2.

803.6.2 Room corner test, textiles. Textile wall coverings shall meet the criteria of Section 803.6.2.1 when tested in the manner intended for use in accordance with the Method B protocol of NFPA 265 using the product-mounting system, including adhesive.

803.6.2.1 Method B test protocol. During the 40 kW exposure, the interior finish shall comply with Item 1. During the 150 kW exposure, the interior finish shall comply with Item 2. During the entire test, the interior finish shall comply with Item 3.

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. During the 150 kW exposure, the interior finish shall comply with the following:
    2.1. Flame shall not spread to the outer extremities of the samples on the 8-foot by 12-foot (203 mm by 305 mm) walls.
    2.2. Flashover, as described in NFPA 265, shall not occur.
3. The total smoke released throughout the NFPA 265 test shall not exceed 1000 m^2.

803.6.3 Room corner test, ceiling and wall finish. Textile wall and ceiling coverings shall meet the criteria of Section 803.2.1 when tested in the manner intended for use in accordance with NFPA 286 using the product-mounting system, including adhesive.

803.7 Expanded vinyl wall coverings. Expanded vinyl wall coverings shall comply with the requirements for textile wall and ceiling materials and their use shall comply with Section 803.6.

Exception: Expanded vinyl wall or ceiling coverings complying with Section 803.2 shall not be required to comply with Section 803.1 or 803.6.

TABLE 803.5
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY[k]

GROUP	SPRINKLERED[l]			NONSPRINKLERED		
	Exit enclosures and exit passageways[a,b]	Corridors	Rooms and enclosed spaces[c]	Exit enclosures and exit passageways[a,b]	Corridors	Rooms and enclosed spaces[c]
A-1 & A-2	B	B	C	A	A[d]	B[e]
A-3[f], A-4, A-5	B	B	C	A	A[d]	C
B, D, E, M, R-1, R-4	B	C	C	A	B	C
F	C	C	C	B	C	C
H	B	B	C[g]	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B[h,i]	A	A	B
I-3	A	A[j]	C	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2.

a. Class C interior finish materials shall be permitted for wainscotting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fireblocked as required by Section 803.4.1.

b. In exit enclosures of buildings less than three stories in height of other than Group I-3, Class B interior finish for nonsprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted.

c. Requirements for rooms and enclosed spaces shall be based upon spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered enclosing spaces and the rooms or spaces on both sides shall be considered one. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.

d. Lobby areas in Group A-1, A-2 and A-3 occupancies shall not be less than Class B materials.

e. Class C interior finish materials shall be permitted in places of assembly with an occupant load of 300 persons or less.

f. For places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be permitted.

g. Class B material is required where the building exceeds two stories.

h. Class C interior finish materials shall be permitted in administrative spaces.

i. Class C interior finish materials shall be permitted in rooms with a capacity of four persons or less.

j. Class B materials shall be permitted as wainscotting extending not more than 48 inches above the finished floor in corridors.

k. Finish materials as provided for in other sections of this code.

l. Applies when the exit enclosures, exit passageways, corridors or rooms and enclosed spaces are protected by a sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

803.8 Insulation. Thermal and acoustical insulation shall comply with Section 719.

803.9 Acoustical ceiling systems. The quality, design, fabrication and erection of metal suspension systems for acoustical tile and lay-in panel ceilings in buildings or structures shall conform with generally accepted engineering practice, the provisions of this chapter and other applicable requirements of this code.

803.9.1 Materials and installation. Acoustical materials complying with the interior finish requirements of Section 803 shall be installed in accordance with the manufacturer's recommendations and applicable provisions for applying interior finish.

803.9.1.1 Suspended acoustical ceilings. Suspended acoustical ceiling systems shall be installed in accordance with the provisions of ASTM C 635 and ASTM C 636.

803.9.1.2 Fire-resistance-rated construction. Acoustical ceiling systems that are part of fire-resistance-rated construction shall be installed in the same manner used in the assembly tested and shall comply with the provisions of Chapter 7.

SECTION 804
INTERIOR FLOOR FINISH

804.1 General. Interior floor finish and floor covering materials shall comply with Sections 804.2 through 804.4.1.

Exception: Floor finishes and coverings of a traditional type, such as wood, vinyl, linoleum or terrazzo, and resilient floor covering materials that are not comprised of fibers.

804.2 Classification. Interior floor finish and floor covering materials required by Section 804.4.1 to be of Class I or II materials shall be classified in accordance with NFPA 253. The classification referred to herein corresponds to the classifica-

tions determined by NFPA 253 as follows: Class I, 0.45 watts/cm^2 or greater; Class II, 0.22 watts/cm^2 or greater.

804.3 Testing and identification. Interior floor finish and floor covering materials shall be tested by an approved agency in accordance with NFPA 253 and identified by a hang tag or other suitable method so as to identify the manufacturer or supplier and style, and shall indicate the interior floor finish or floor covering classification according to Section 804.2. Carpet-type floor coverings shall be tested as proposed for use, including underlayment. Test reports confirming the information provided in the manufacturer's product identification shall be furnished to the building official upon request.

804.4 Interior floor finish requirements. In all occupancies, interior floor finish and floor covering materials in exit enclosures, exit passageways, corridors and rooms or spaces not separated from corridors by full-height partitions extending from the floor to the underside of the ceiling shall withstand a minimum critical radiant flux as specified in Section 804.4.1.

804.4.1 Minimum critical radiant flux. Interior floor finish and floor covering materials in exit enclosures, exit passageways and corridors shall not be less than Class I in Groups I-2 and I-3 and not less than Class II in Groups A, B, E, H, I-4, M, R-1, R-2 and S. In all areas, floor covering materials shall comply with the DOC FF-1 "pill test" (CPSC 16 CFR, Part 1630).

Exception: Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, Class II materials are permitted in any area where Class I materials are required, and materials complying with the DOC FF-1 "pill test" (CPSC 16 CFR, Part 1630) are permitted in any area where Class II materials are required.

SECTION 805
COMBUSTIBLE MATERIALS IN TYPES I AND II CONSTRUCTION

805.1 Application. Combustible materials installed on or embedded in floors of buildings of Type I or II construction shall comply with Sections 805.1.1 through 805.1.3.

Exception: Stages and platforms constructed in accordance with Sections 410.3 and 410.4, respectively.

805.1.1 Subfloor construction. Floor sleepers, bucks and nailing blocks shall not be constructed of combustible materials, unless the space between the fire-resistance-rated floor construction and the flooring is either solidly filled with approved noncombustible materials or fireblocked in accordance with Section 717, and provided that such open spaces shall not extend under or through permanent partitions or walls.

805.1.2 Wood finish flooring. Wood finish flooring is permitted to be attached directly to the embedded or fireblocked wood sleepers and shall be permitted where cemented directly to the top surface of approved fire-resistance-rated floor construction or directly to a wood subfloor attached to sleepers as provided for in Section 805.1.1.

805.1.3 Insulating boards. Combustible insulating boards not more than $^1/_2$ inch (12.7 mm) thick and covered with approved finish flooring are permitted where attached directly to a noncombustible floor assembly or to wood subflooring attached to sleepers as provided for in Section 805.1.1.

[F] SECTION 806
DECORATIVE MATERIALS AND TRIM

[F] 806.1 General requirements. In occupancies in Groups A, E, I and R-1 and dormitories in Group R-2, curtains, draperies, hangings and other decorative materials suspended from walls or ceilings shall meet the flame propagation performance criteria of NFPA 701 in accordance with Section 806.2 or be noncombustible.

In Groups I-1 and I-2, combustible decorative materials shall meet the flame propagation criteria of NFPA 701 unless the decorative materials, including, but not limited to, photographs and paintings, are of such limited quantities that a hazard of fire development or spread is not present. In Group I-3, combustible decorative materials are prohibited.

Fixed or movable walls and partitions, paneling, wall pads and crash pads applied structurally or for decoration, acoustical correction, surface insulation or other purposes shall be considered interior finish if they cover 10 percent or more of the wall or of the ceiling area, and shall not be considered decorative materials or furnishings.

In Group B and M occupancies, fabric partitions suspended from the ceiling and not supported by the floor shall meet the flame propagation performance criteria in accordance with Section 806.2 and NFPA 701 or shall be noncombustible.

[F] 806.1.1 Noncombustible materials. The permissible amount of noncombustible decorative material shall not be limited.

[F] 806.1.2 Combustible decorative materials. The permissible amount of decorative materials meeting the flame propagation performance criteria of NFPA 701 shall not exceed 10 percent of the aggregate area of walls and ceilings.

Exceptions:

1. In auditoriums in Group A, the permissible amount of decorative material meeting the flame propagation performance criteria of NFPA 701 shall not exceed 50 percent of the aggregate area of walls and ceiling where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and where the material is installed in accordance with Section 803.4.
2. The amount of fabric partitions suspended from the ceiling and not supported by the floor in Group B and M occupancies shall not be limited.

[F] 806.2 Acceptance criteria and reports. Where required by Section 806.1, decorative materials shall be tested by an approved agency and meet the flame propagation performance criteria of NFPA 701 or such materials shall be

noncombustible. Reports of test results shall be prepared in accordance with NFPA 701 and furnished to the building official upon request.

[F] 806.3 Foam plastic. Foam plastic used as trim in any occupancy shall comply with Section 2604.2.

[F] 806.4 Pyroxylin plastic. Imitation leather or other material consisting of or coated with a pyroxylin or similarly hazardous base shall not be used in Group A occupancies.

[F] 806.5 Interior trim. Material, other than foam plastic used as interior trim shall have a minimum Class C flame spread and smoke-developed index when tested in accordance with ASTM E 84, as described in Section 803.1. Combustible trim, excluding handrails and guardrails, shall not exceed 10 percent of the aggregate wall or ceiling area in which it is located.

CHAPTER 9
FIRE PROTECTION SYSTEMS

SECTION 901
GENERAL

901.1 Scope. The provisions of this chapter shall specify where fire protection systems are required and shall apply to the design, installation and operation of fire protection systems.

901.2 Fire protection systems. Fire protection systems shall be installed, repaired, operated and maintained in accordance with this code and the *Florida Fire Prevention Code.*

Any fire protection system for which an exception or reduction to the provisions of this code has been granted shall be considered to be a required system.

Exception: Any fire protection system or portion thereof not required by this code shall be permitted to be installed for partial or complete protection provided that such system meets the requirements of this code.

901.3 Modifications. No person shall remove or modify any fire protection system installed or maintained under the provisions of this code or the *Florida Fire Prevention Code* without approval by the building official.

901.4 Threads. Threads provided for fire department connections to sprinkler systems, standpipes, yard hydrants or any other fire hose connection shall be compatible with the connections used by the local fire department.

901.5 Acceptance tests. Fire protection systems shall be tested in accordance with the requirements of this code and the *Florida Fire Prevention Code*. When required, the tests shall be conducted in the presence of the building official. Tests required by this code, the *Florida Fire Prevention Code* and the standards listed in this code shall be conducted at the expense of the owner or the owner's representative. It shall be unlawful to occupy portions of a structure until the required fire protection systems within that portion of the structure have been tested and approved.

901.6 Supervisory service. Where required, fire protection systems shall be monitored by an approved supervising station in accordance with NFPA 72.

901.6.1 Automatic sprinkler systems. Automatic sprinkler systems shall be monitored for integrity in accordance with NFPA 72, *National Fire Alarm Code.*

Exceptions:

1. A supervising station is not required for automatic sprinkler systems protecting one- and two-family dwellings.
2. Limited area systems serving fewer than 20 sprinklers.

901.6.2 Fire alarm systems. Fire alarm systems required by the provisions of Section 907.2 of this code and the *Florida Fire Prevention Code* shall be monitored by an approved supervising station in accordance with Section 907.14.

Exceptions:

1. Single- and multiple-station smoke alarms required by Section 907.2.10.
2. Smoke detectors in Group I-3 occupancies.
3. Supervisory service is not required for automatic sprinkler systems in one- and two-family dwellings.

901.6.3 Group H. Manual fire alarm, automatic fire-extinguishing and emergency alarm systems in Group H occupancies shall be monitored by an approved supervising station.

Exception: When approved by the building official, on-site monitoring at a constantly attended location shall be permitted provided that notifications to the fire department will be equal to those provided by an approved supervising station.

901.7 Fire areas. Where buildings, or portions thereof, are divided into fire areas so as not to exceed the limits established for requiring a fire protection system in accordance with this chapter, such fire areas shall be separated by fire barriers having a fire-resistance rating of not less than that determined in accordance with Section 706.3.9.

SECTION 902
DEFINITIONS

902.1 Definitions. The following words and terms shall, for the purposes of this chapter, and as used elsewhere in this code, have the meanings shown herein.

[F] ALARM NOTIFICATION APPLIANCE. A fire alarm system component such as a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof.

[F] ALARM SIGNAL. A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.

[F] ALARM VERIFICATION FEATURE. A feature of automatic fire detection and alarm systems to reduce unwanted alarms wherein smoke detectors report alarm conditions for a minimum period of time, or confirm alarm conditions within a given time period, after being automatically reset, in order to be accepted as a valid alarm-initiation signal.

[F] ANNUNCIATOR. A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.

[F] AUDIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of hearing.

[F] AUTOMATIC. As applied to fire protection devices, is a device or system providing an emergency function without the necessity for human intervention and activated as a result of a

predetermined temperature rise, rate of temperature rise or combustion products.

[F] AUTOMATIC FIRE-EXTINGUISHING SYSTEM. An approved system of devices and equipment which automatically detects a fire and discharges an approved fire-extinguishing agent onto or in the area of a fire.

[F] AUTOMATIC SPRINKLER SYSTEM. A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.

[F] AVERAGE AMBIENT SOUND LEVEL. The root mean square, A-weighted sound pressure level measured over a 24-hour period.

[F] CARBON DIOXIDE EXTINGUISHING SYSTEMS. A system supplying carbon dioxide (CO_2) from a pressurized vessel through fixed pipes and nozzles. The system includes a manual- or automatic-actuating mechanism.

[F] CEILING LIMIT. The maximum concentration of an air-borne contaminant to which one may be exposed, as published in DOL 29 CFR Part 1910.1000.

[F] CLEAN AGENT. Electrically nonconducting, volatile or gaseous fire extinguishant that does not leave a residue upon evaporation.

[F] CONSTANTLY ATTENDED LOCATION. A designated location at a facility staffed by trained personnel on a continuous basis where alarm or supervisory signals are monitored and facilities are provided for notification of the fire department or other emergency services.

[F] DELUGE SYSTEM. A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

[F] DETECTOR, HEAT. A fire detector that senses heat produced by burning substances. Heat is the energy produced by combustion that causes substances to rise in temperature.

[F] DRY-CHEMICAL EXTINGUISHING AGENT. A powder composed of small particles, usually of sodium bicarbonate, potassium bicarbonate, urea-potassium-based bicarbonate, potassium chloride or monoammonium phosphate, with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking) and the proper flow capabilities.

[F] EMERGENCY ALARM SYSTEM. A system to provide indication and warning of emergency situations involving hazardous materials.

[F] EMERGENCY VOICE/ALARM COMMUNICATIONS. Dedicated manual or automatic facilities for originating and distributing voice instructions, as well as alert and evacuation signals pertaining to a fire emergency, to the occupants of a building.

[F] EXPLOSION. An effect produced by the sudden violent expansion of gases, that is accompanied by a shock wave or disruption of enclosing materials or structures, or both.

[F] FIRE ALARM BOX, MANUAL. See "Manual Fire Alarm Box."

[F] FIRE ALARM CONTROL UNIT. A system component that receives inputs from automatic and manual fire alarm devices and is capable of supplying power to detection devices and transponder(s) or off-premises transmitter(s). The control unit is capable of providing a transfer of power to the notification appliances and transfer of condition to relays or devices.

[F] FIRE ALARM SIGNAL. A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, water flow switch, or other device whose activation is indicative of the presence of a fire or fire signature.

[F] FIRE ALARM SYSTEM. A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

[F] FIRE COMMAND CENTER. The principal attended or unattended location where the status of detection, alarm communications and control systems is displayed, and from which the system(s) can be manually controlled.

[F] FIRE DETECTOR, AUTOMATIC. A device designed to detect the presence of a fire signature and to initiate action.

[F] FIRE PROTECTION SYSTEM. Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.

[F] FIRE SAFETY FUNCTIONS. Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of harmful effects of fire.

[F] FOAM-EXTINGUISHING SYSTEM. A special system discharging a foam made from concentrates, either mechanically or chemically, over the area to be protected.

[F] HALOGENATED EXTINGUISHING SYSTEM. A fire-extinguishing system using one or more atoms of an element from the halogen chemical series: fluorine, chlorine, bromine and iodine.

[F] INITIATING DEVICE. A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box or supervisory switch.

[F] LISTED. Equipment, materials or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material or service meets identified standards or has been tested and found suitable for a specified purpose.

[F] MANUAL FIRE ALARM BOX. A manually operated device used to initiate an alarm signal.

[F] MULTIPLE-STATION ALARM DEVICE. Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate. It also can consist of one single-station alarm device having connections to other detectors or to a manual fire alarm box.

[F] MULTIPLE-STATION SMOKE ALARM. Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.

[F] NUISANCE ALARM. An alarm caused by mechanical failure, malfunction, improper installation or lack of proper maintenance, or an alarm activated by a cause that cannot be determined.

[F] RECORD DRAWINGS. Drawings ("as builts") that document the location of all devices, appliances, wiring sequences, wiring methods and connections of the components of a fire alarm system as installed.

[F] SINGLE-STATION SMOKE ALARM. An assembly incorporating the detector, the control equipment and the alarm-sounding device in one unit, operated from a power supply either in the unit or obtained at the point of installation.

[F] SMOKE ALARM. A single- or multiple-station alarm responsive to smoke and not connected to a system.

[F] SMOKE DETECTOR. A listed device that senses visible or invisible particles of combustion.

SMOKEPROOF ENCLOSURE. An exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.

[F] STANDPIPE SYSTEM, CLASSES OF. Standpipe classes are as follows:

Class I system. A system providing $2^1/_2$-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

Class II system. A system providing $1^1/_2$-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.

Class III system. A system providing $1^1/_2$-inch (38 mm) hose stations to supply water for use by building occupants and 2.5-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

[F] STANDPIPE, TYPES OF. Standpipe types are as follows:

Automatic dry. A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a device, such as dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand.

Automatic wet. A wet standpipe system that has a water supply that is capable of supplying the system demand automatically.

Manual dry. A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to meet the system demand.

Manual wet. A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but does not have a water supply capable of delivering the system demand attached to the system. Manual-wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to meet the system demand.

Semiautomatic dry. A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

[F] SUPERVISING STATION. A facility that receives signals and at which personnel are in attendance at all times to respond to these signals.

[F] SUPERVISORY SERVICE. The service required to monitor performance of guard tours and the operative condition of fixed suppression systems or other systems for the protection of life and property.

[F] SUPERVISORY SIGNAL. A signal indicating the need of action in connection with the supervision of guard tours, the fire suppression systems or equipment or the maintenance features of related systems.

[F] SUPERVISORY SIGNAL-INITIATING DEVICE. An initiation device, such as a valve supervisory switch, water-level indicator or low-air pressure switch on a dry-pipe sprinkler system, whose change of state signals an off-normal condition and its restoration to normal of a fire protection or life safety system, or a need for action in connection with guard tours, fire suppression systems or equipment or maintenance features of related systems.

[F] TIRES, BULK STORAGE OF. Storage of tires where the area available for storage exceeds 20,000 cubic feet (566 m^3).

[F] TROUBLE SIGNAL. A signal initiated by the fire alarm system or device indicative of a fault in a monitored circuit or component.

[F] VISIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of sight.

[F] WET-CHEMICAL EXTINGUISHING SYSTEM. A solution of water and potassium-carbonate-based chemical, potassium-acetate-based chemical or a combination thereof, forming an extinguishing agent.

[F] WIRELESS PROTECTION SYSTEM. A system or a part of a system that can transmit and receive signals without the aid of wire.

[F] ZONE. A defined area within the protected premises. A zone can define an area from which a signal can be received, an

area to which a signal can be sent or an area in which a form of control can be executed.

SECTION 903
AUTOMATIC SPRINKLER SYSTEMS

[F] 903.1 General. Automatic sprinkler systems shall comply with this section.

[F] 903.1.1 Alternative protection. Alternative automatic fire-extinguishing systems complying with Section 904 shall be permitted in lieu of automatic sprinkler protection where recognized by the applicable standard and approved by the fire code official.

[F] 903.2 Where required. Approved automatic sprinkler systems in new buildings and structures shall be provided in the locations described in this section.

Exception: Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided those spaces or areas are equipped throughout with an automatic fire alarm system and are separated from the remainder of the building by fire barriers consisting of not less than 1-hour fire-resistance-rated walls and 2-hour fire-resistance-rated floor/ceiling assemblies.

[F] 903.2.1 Group A. An automatic sprinkler system shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section. For Group A-1, A-2, A-3 and A-4 occupancies, the automatic sprinkler system shall be provided throughout the floor area where the Group A-1, A-2, A-3 or A-4 occupancy is located, and in all floors between the Group A occupancy and the level of exit discharge. For Group A-5 occupancies, the automatic sprinkler system shall be provided in the spaces indicated in Section 903.2.1.5.

[F] 903.2.1.1 Group A-1. An automatic sprinkler system shall be provided for Group A-1 occupancies where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m^2).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than the level of exit discharge.
4. The fire area contains a multitheater complex.

[F] 903.2.1.2 Group A-2. An automatic sprinkler system shall be provided for Group A-2 occupancies where one of the following conditions exists:

1. The fire area exceeds 5,000 square feet (464.5 m^2).
2. The fire area has an occupant load of 100 or more.
3. The fire area is located on a floor other than the level of exit discharge.
4. Nightclubs or similar usage when occupant load is 100 or more.

[F] 903.2.1.3 Group A-3. An automatic sprinkler system shall be provided for Group A-3 occupancies where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m^2).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than the level of exit discharge.

Exceptions:

1. Areas used exclusively as participant sports areas where the main floor area is located at the same level as the level of exit discharge of the main entrance and exit.
2. Assembly occupancies used primarily for worship with fixed seating and not part of a mixed occupancy.

[F] 903.2.1.4 Group A-4. An automatic sprinkler system shall be provided for Group A-4 occupancies where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m^2).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than the level of exit discharge.

Exception: Areas used exclusively as participant sports areas where the main floor area is located at the same level as the level of exit discharge of the main entrance and exit.

[F] 903.2.1.5 Group A-5. An automatic sprinkler system shall be provided for Group A-5 occupancies in the following areas: concession stands, retail areas, press boxes and other accessory use areas in excess of 1,000 square feet (93 m^2).

[F] 903.2.2 Group E. An automatic sprinkler system shall be provided for Group E occupancies as follows:

1. Throughout all Group E fire areas greater than 20,000 square feet (1858 m^2) in area.
2. Throughout every portion of educational buildings below the level of exit discharge.

Exception: An automatic sprinkler system is not required in existing educational buildings unless 50 percent of the aggregate area of the building is being remodeled.

[F] 903.2.3 Group F-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. Where a Group F-1 fire area exceeds 12,000 square feet (1115 m^2);
2. Where a Group F-1 fire area is located more than three stories above grade plane; or

3. Where the combined area of all Group F-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m^2).

[F] 903.2.3.1 Woodworking operations. An automatic sprinkler system shall be provided throughout all Group F-1 occupancy fire areas that contain woodworking operations in excess of 2,500 square feet (232 m^2) in area which generate finely divided combustible waste or use finely divided combustible materials.

[F] 903.2.4 Group H. Automatic sprinkler systems shall be provided in high-hazard occupancies as required in Sections 903.2.4.1 through 903.2.4.3.

[F] 903.2.4.1 General. An automatic sprinkler system shall be installed in Group H occupancies.

[F] 903.2.4.2 Group H-5. An automatic sprinkler system shall be installed throughout buildings containing Group H-5 occupancies. The design of the sprinkler system shall not be less than that required by this code for the occupancy hazard classifications in accordance with Table 903.2.4.2. Where the design area of the sprinkler system consists of a corridor protected by one row of sprinklers, the maximum number of sprinklers required to be calculated is 13.

[F] TABLE 903.2.4.2
GROUP H-5 SPRINKLER DESIGN CRITERIA

LOCATION	OCCUPANCY HAZARD CLASSIFICATION
Fabrication areas	Ordinary Hazard Group 2
Service corridors	Ordinary Hazard Group 2
Storage rooms without dispensing	Ordinary Hazard Group 2
Storage rooms with dispensing	Extra Hazard Group 2
Corridors	Ordinary Hazard Group 2

[F] 903.2.4.3 Pyroxylin plastics. An automatic sprinkler system shall be provided in buildings, or portions thereof, where cellulose nitrate film or pyroxylin plastics are manufactured, stored or handled in quantities exceeding 100 pounds (45 kg).

[F] 903.2.5 Group I. An automatic sprinkler system shall be provided throughout buildings with a Group I fire area.

Exception: An automatic sprinkler system installed in accordance with Section 903.3.1.2 or 903.3.1.3 shall be allowed in Group I-1 facilities.

[F] 903.2.6 Group M. An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:

1. Where a Group M fire area exceeds 12,000 square feet (1115 m^2);
2. Where a Group M fire area is located more than three stories above grade plane; or
3. Where the combined area of all Group M fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m^2).

[F] 903.2.6.1 High-piled storage. An automatic sprinkler system shall be provided in accordance with the *Florida Fire Prevention Code* in all buildings of Group M where storage of merchandise is in high-piled or rack storage arrays.

[F] 903.2.7 Group R. An automatic sprinkler system installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R fire area.

[F] 903.2.8 Group S-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

1. A Group S-1 fire area exceeds 12,000 square feet (1115 m^2);
2. A Group S-1 fire area is located more than three stories above grade plane; or
3. The combined area of all Group S-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m^2).

[F] 903.2.8.1 Repair garages. An automatic sprinkler system shall be provided throughout all buildings used as repair garages in accordance with Section 406, as shown:

1. Buildings two or more stories in height, including basements, with a fire area containing a repair garage exceeding 10,000 square feet (929 m^2).
2. One-story buildings with a fire area containing a repair garage exceeding 12,000 square feet (1115 m^2).
3. Buildings with a repair garage servicing vehicles parked in the basement.

[F] 903.2.8.2 Bulk storage of tires. Buildings and structures where the area for the storage of tires exceeds 20,000 cubic feet (566 m^3) shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

[F] 903.2.9 Group S-2. An automatic sprinkler system shall be provided throughout buildings classified as enclosed parking garages in accordance with Section 406.4 or where located beneath other groups.

Exception: Enclosed parking garages located beneath Group R-3 occupancies.

[F] 903.2.9.1 Commercial parking garages. An automatic sprinkler system shall be provided throughout buildings used for storage of commercial trucks or buses where the fire area exceeds 5,000 square feet (464 m^2).

[F] 903.2.10 Windowless stories in all occupancies. An automatic sprinkler system shall be installed in the locations set forth in Sections 903.2.10.1 through 903.2.10.1.3.

Exception: Group R-3 and Group U.

[F] 903.2.10.1 Stories and basements without openings. An automatic sprinkler system shall be installed throughout every story or basement of all buildings where the floor area exceeds 1,500 square feet (139.4 m^2) and where there is not provided at least one of the following types of exterior wall openings:

1. Openings below grade that lead directly to ground level by an exterior stairway complying with Section 1009 or an outside ramp complying with Section 1010. Openings shall be located in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on at least one side.
2. Openings entirely above the adjoining ground level totaling at least 20 square feet (1.86 m^2) in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on at least one side.

[F] 903.2.10.1.1 Opening dimensions and access. Openings shall have a minimum dimension of not less than 30 inches (762 mm). Such openings shall be accessible to the fire department from the exterior and shall not be obstructed in a manner that fire fighting or rescue cannot be accomplished from the exterior.

[F] 903.2.10.1.2 Openings on one side only. Where openings in a story are provided on only one side and the opposite wall of such story is more than 75 feet (22 860 mm) from such openings, the story shall be equipped throughout with an approved automatic sprinkler system, or openings as specified above shall be provided on at least two sides of the story.

[F] 903.2.10.1.3 Basements. Where any portion of a basement is located more than 75 feet (22 860 mm) from openings required by Section 903.2.10.1, the basement shall be equipped throughout with an approved automatic sprinkler system.

[F] 903.2.10.2 Rubbish and linen chutes. An automatic sprinkler system shall be installed at the top of rubbish and linen chutes and in their terminal rooms. Chutes extending through three or more floors shall have additional sprinkler heads installed within such chutes at alternate floors. Chute sprinklers shall be accessible for servicing.

[F] 903.2.10.3 Buildings 55 feet or more in height. Reserved.

[F] 903.2.11 During construction. Automatic sprinkler systems required during construction, alteration and demolition operations shall be provided in accordance with the *Florida Fire Prevention Code*.

[F] 903.2.12 Other hazards. Automatic sprinkler protection shall be provided for the hazards indicated in Sections 903.2.12.1 and 903.2.12.2.

[F] 903.2.12.1 Ducts conveying hazardous exhausts. Where required by the *Florida Building Code, Mechanical*, automatic sprinklers shall be provided in ducts conveying hazardous exhaust, or flammable or combustible materials.

Exception: Ducts in which the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).

[F] 903.2.12.2 Commercial cooking operations. An automatic sprinkler system shall be installed in commercial kitchen exhaust hood and duct system where an automatic sprinkler system is used to comply with Section 904.

[F] 903.2.13 Other required suppression systems. In addition to the requirements of Section 903.2, the provisions indicated in Table 903.2.13 also require the installation of a suppression system for certain buildings and areas.

[F] TABLE 903.2.13
ADDITIONAL REQUIRED SUPPRESSION SYSTEMS

SECTION	SUBJECT
402.8	Covered malls
403.2, 403.3	High-rise buildings
404.3	Atriums
405.3	Underground structures
407.5	Group I-2
410.6	Stages
411.4	Special amusement buildings
412.2.5, 412.2.6	Aircraft hangars
415.6.2.4	Group H-2
416.4	Flammable finishes
417.4	Drying rooms
507	Unlimited area buildings
508.2	Incidental use areas
1025.6.2.3	Smoke-protected assembly seating
FFPC	Sprinkler system requirements as set forth in the *Florida Fire Prevention Code*

[F] 903.3 Installation requirements. Automatic sprinkler systems shall be designed and installed in accordance with Sections 903.3.1 through 903.3.7.

[F] 903.3.1 Standards. Sprinkler systems shall be designed and installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3.

[F] 903.3.1.1 NFPA 13 sprinkler systems. Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in Section 903.3.1.1.1.

[F] 903.3.1.1.1 Exempt locations. Automatic sprinklers shall not be required in the following rooms or areas where such rooms or areas are protected with an approved automatic fire detection system, in accordance with Section 907.2, that will respond to visible or invisible particles of combustion. Sprinklers shall not be omitted from any room merely because it is damp, of fire-resistance-rated construction or contains electrical equipment.

1. Any room where the application of water, or flame and water, constitutes a serious life or fire hazard.

2. Any room or space where sprinklers are considered undesirable because of the nature of the contents, when approved by the fire code official.
3. Generator and transformer rooms separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire-resistance rating of not less than 2 hours.
4. In rooms or areas that are of noncombustible construction with wholly noncombustible contents.

[F] 903.3.1.2 NFPA 13R sprinkler systems. Where allowed in buildings of Group R, up to and including four stories in height, automatic sprinkler systems shall be installed throughout in accordance with NFPA 13R.

[F] 903.3.1.2.1 Balconies and decks. Sprinkler protection shall be provided for exterior balconies, decks and ground floor patios of dwelling units where the building is of Type V construction. Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch (25 mm) to 6 inches (152 mm) below the structural members and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies and decks that are constructed of open wood joist construction.

[F] 903.3.1.3 NFPA 13D sprinkler systems. Where allowed, automatic sprinkler systems in one- and two-family dwellings shall be installed throughout in accordance with NFPA 13D.

903.3.1.4 In Group R4 Small Facilities, an automated sprinkler systems installed in accordance with NFPA 13D or 13R with their scopes shall be permitted, provided the automatic sprinkler system is not be considered an alternative to other requirements of the code.

[F] 903.3.2 Quick-response and residential sprinklers. Where automatic sprinkler systems are required by this code, quick-response or residential automatic sprinklers shall be installed in the following areas in accordance with Section 903.3.1 and their listings:

1. Throughout all spaces within a smoke compartment containing patient sleeping units in Group I-2 in accordance with this code.
2. Dwelling units, and sleeping units in Group R and I-1 occupancies.
3. Light-hazard occupancies as defined in NFPA 13.

[F] 903.3.3 Obstructed locations. Automatic sprinklers shall be installed with due regard to obstructions that will delay activation or obstruct the water distribution pattern. Automatic sprinklers shall be installed in or under covered kiosks, displays, booths, concession stands, or equipment that exceeds 4 feet (1219 mm) in width. Not less than a 3-foot (914 mm) clearance shall be maintained between automatic sprinklers and the top of piles of combustible fibers.

Exception: Kitchen equipment under exhaust hoods protected with a fire-extinguishing system in accordance with Section 904.

[F] 903.3.4 Actuation. Automatic sprinkler systems shall be automatically actuated unless specifically provided for in this code.

[F] 903.3.5 Water supplies. Water supplies for automatic sprinkler systems shall comply with this section and the standards referenced in Section 903.3.1. The potable water supply shall be protected against backflow in accordance with the requirements of this section and the *Florida Building Code, Plumbing*.

[F] 903.3.5.1 Domestic services. Where the domestic service provides the water supply for the automatic sprinkler system, the supply shall be in accordance with this section.

[F] 903.3.5.1.1 Limited area sprinkler systems. Limited area sprinkler systems serving six sprinklers or less on any single connection are permitted to be connected to the domestic service where a wet automatic standpipe is not available. Limited area sprinkler systems connected to domestic water supplies shall comply with each of the following requirements:

1. Valves shall not be installed between the domestic water riser control valve and the sprinklers.

   Exception: An approved indicating control valve supervised in the open position in accordance with Section 903.4.

2. The domestic service shall be capable of supplying the simultaneous domestic demand and the sprinkler demand required to be hydraulically calculated by NFPA 13, NFPA 13R or NFPA 13D.

[F] 903.3.5.1.2 Residential combination services. A single combination water supply shall be allowed provided that the domestic demand is added to the sprinkler demand as required by NFPA 13R.

[F] 903.3.5.2 Secondary water supply. Reserved.

[F] 903.3.6 Hose threads. Fire hose threads and fittings used in connection with automatic sprinkler systems shall be as prescribed by the fire code official.

[F] 903.4 Sprinkler system monitoring and alarms. All valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and temperatures, critical air pressures and water-flow switches on all sprinkler systems shall be electrically supervised in accordance with NFPA 72.

Exceptions:

1. Automatic sprinkler systems protecting one- and two-family dwellings.
2. Limited area systems serving six sprinklers or less.
3. Automatic sprinkler systems installed in accordance with NFPA 13R where a common supply main is used to supply both domestic water and the automatic sprinkler systems and a separate shutoff valve for the automatic sprinkler system is not provided.
4. Jockey pump control valves that are sealed or locked in the open position.

5. Control valves to commercial kitchen hoods, paint spray booths or dip tanks that are sealed or locked in the open position.
6. Valves controlling the fuel supply to fire pump engines that are sealed or locked in the open position.
7. Trim valves to pressure switches in dry, preaction and deluge sprinkler systems that are sealed or locked in the open position.

[F] 903.4.1 Signals. Alarm, supervisory and trouble signals shall be distinctly different and automatically transmitted to an approved central station, remote supervising station or proprietary supervising station as defined in NFPA 72 or, when approved by the fire code official, shall sound an audible signal at a constantly attended location.

Exceptions:

1. Underground key or hub valves in roadway boxes provided by the municipality or public utility are not required to be monitored.
2. Backflow prevention device test valves located in limited area sprinkler system supply piping shall be locked in the open position. In occupancies required to be equipped with a fire alarm system, the backflow preventer valves shall be electrically supervised by a tamper switch installed in accordance with NFPA 72 and separately annunciated.

[F] 903.4.2 Alarms. Approved audible devices shall be connected to every automatic sprinkler system. Such sprinkler water-flow alarm devices shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Alarm devices shall be provided on the exterior of the building in an approved location. Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system.

[F] 903.4.3 Floor control valves. Approved supervised indicating control valves shall be provided at the point of connection to the riser on each floor in high-rise buildings.

[F] 903.5 Testing and maintenance. Sprinkler systems shall be tested and maintained in accordance with the *Florida Fire Prevention Code*.

903.6 Buildings three stories or more in height.

903.6.1 Any building which is of three stories or more in height shall be equipped with an approved automatic sprinkler system installed in accordance with Section 903.1.

Exceptions:

1. Single- and two-family dwellings.
2. A stand-alone parking garage constructed with noncombustible materials, the design of which is such that all levels of the garage are uniformly open to the atmosphere on all sides with the percentages of openings equal to or greater than those specified in Section 406.3. Such garages shall be separated from any other structure by not less than 20 feet (6096 mm). A stand-alone parking garage is one that is solely for the parking of vehicles and does not have any other occupancy group in the building.
3. Telecommunication spaces located within telecommunication buildings, if the spaces are equipped to meet an equivalent fire prevention standard approved by both the Florida Building Commission and the State Fire Marshal.
4. Telecommunications spaces within telecommunication buildings, if the telecommunications space is equipped with:
   4.1. Air sampling smoke detection.
   4.2. Remote, proprietary or central station fire alarm monitoring.
   4.3. Automatic smoke exhaust system.
   4.4. One-hour fire-resistant wall separating the telecommunications space from the adjacent areas on the same floor.
   4.5. Two-hour floor/ceiling assembly separating the telecommunications space from adjacent floors.
   4.6. All other portions ancillary to the telecommunications equipment area shall be provided with fire sprinkler protection.
5. Sprinkler systems installed solely as a requirement of Section 903.6 may be a NFPA 13R or NFPA 13D system in accordance with their scopes.

903.6.2 NFPA 101 as adopted by *Florida Fire Prevention Code*, as regarding the requirements for fire protection sprinklers, is applicable to all multiple-family residential buildings, whether designated as townhouses, condominiums, apartment houses, tenements, garden apartments or by any other name. The attorney general has determined that for the purpose of the fire protection sprinkler requirements in Section 553.895(2), *Florida Statutes*, townhouses that are three or more stories tall and consist of three or more units together are multiple-family dwellings. Therefore, these types of townhouses are not exempt from being considered for the requirements to provide fire protection sprinklers (even if there are any other definitions that define a townhouse as a single-family residence). When determining whether townhouses require fire protection sprinkler systems, the building official must consider in parallel: (a) the attorney general's opinion defining the statutory language for townhouses; (b) the building code requirements, including all life-safety chapters, that provide additional determining criteria, such as construction types, fire-resistance, fire protection systems and egress; and (c) the NFPA 101 as adopted by *Florida Fire Prevention Code*, egress and protection determining criteria. The more restrictive criteria are then applied.

SECTION 904
ALTERNATIVE AUTOMATIC FIRE-EXTINGUISHING SYSTEMS

[F] 904.1 General. Automatic fire-extinguishing systems, other than automatic sprinkler systems, shall be designed, installed, inspected, tested and maintained in accordance with the provisions of this section and the applicable referenced standards.

[F] 904.2 Where required. Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of Section 903 shall be approved by the fire code official. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions allowed by other requirements of this code.

[F] 904.2.1 Commercial hood and duct systems. Each required commercial kitchen exhaust hood and duct system required by the *Florida Fire Prevention Code* or Chapter 5 of the *Florida Building Code, Mechanical* to have a Type I hood shall be protected with an approved automatic fire-extinguishing system installed in accordance with this code.

[F] 904.3 Installation. Automatic fire-extinguishing systems shall be installed in accordance with this section.

[F] 904.3.1 Electrical wiring. Electrical wiring shall be in accordance with the Chapter 27 of this code.

[F] 904.3.2 Actuation. Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance with Section 904.11.1.

[F] 904.3.3 System interlocking. Automatic equipment interlocks with fuel shutoffs, ventilation controls, door closers, window shutters, conveyor openings, smoke and heat vents and other features necessary for proper operation of the fire-extinguishing system shall be provided as required by the design and installation standard utilized for the hazard.

[F] 904.3.4 Alarms and warning signs. Where alarms are required to indicate the operation of automatic fire-extinguishing systems, distinctive audible and visible alarms and warning signs shall be provided to warn of pending agent discharge. Where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Audible signals shall be in accordance with Section 907.9.2.

[F] 904.3.5 Monitoring. Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with NFPA 72.

[F] 904.4 Inspection and testing. Automatic fire-extinguishing systems shall be inspected and tested in accordance with the provisions of this section prior to acceptance.

[F] 904.4.1 Inspection. Prior to conducting final acceptance tests, the following items shall be inspected:

1. Hazard specification for consistency with design hazard.
2. Type, location and spacing of automatic- and manual-initiating devices.
3. Size, placement and position of nozzles or discharge orifices.
4. Location and identification of audible and visible alarm devices.
5. Identification of devices with proper designations.
6. Operating instructions.

[F] 904.4.2 Alarm testing. Notification appliances, connections to fire alarm systems and connections to approved supervising stations shall be tested in accordance with this section and Section 907 to verify proper operation.

[F] 904.4.2.1 Audible and visible signals. The audibility and visibility of notification appliances signaling agent discharge or system operation, where required, shall be verified.

[F] 904.4.3 Monitor testing. Connections to protected premises and supervising station fire alarm systems shall be tested to verify proper identification and retransmission of alarms from automatic fire-extinguishing systems.

[F] 904.5 Wet-chemical systems. Wet-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 17A and their listing.

[F] 904.6 Dry-chemical systems. Dry-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 17 and their listing.

[F] 904.7 Foam systems. Foam-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 11 and NFPA 16 and their listing.

[F] 904.8 Carbon dioxide systems. Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 12 and their listing.

[F] 904.9 Halon systems. Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 12A and their listing.

[F] 904.10 Clean-agent systems. Clean-agent fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 2001 and their listing.

[F] 904.11 Commercial cooking systems. The automatic fire-extinguishing system for commercial cooking systems shall be of a type recognized for protection of commercial cooking equipment and exhaust systems of the type and arrangement protected. Preengineered automatic dry- and wet-chemical extinguishing systems shall be tested in accordance with UL 300 and listed and labeled for the intended application. Other types of automatic fire-extinguishing systems shall be listed and labeled for specific use as protection for commercial cooking operations. The system shall be installed in accordance with this code, its listing and the manufacturer's installation instructions. Automatic fire-extinguishing systems

of the following types shall be installed in accordance with the referenced standard indicated, as follows:

1. Carbon dioxide extinguishing systems, NFPA 12.
2. Automatic sprinkler systems, NFPA 13.
3. Foam-water sprinkler system or foam-water spray systems, NFPA 16.
4. Dry-chemical extinguishing systems, NFPA 17.
5. Wet-chemical extinguishing systems, NFPA 17A.

Exception: Factory-built commercial cooking recirculating systems that are tested in accordance with UL 710B and listed, labeled and installed in accordance with Section 304.1 of the *Florida Building Code, Mechanical.*

[F] 904.11.1 Manual system operation. A manual actuation device shall be located at or near a means of egress from the cooking area a minimum of 10 feet (3048 mm) and a maximum of 20 feet (6096 mm) from the kitchen exhaust system. The manual actuation device shall be installed not more than 48 inches (1200 mm) or less than 42 inches (1067 mm) above the floor and shall clearly identify the hazard protected. The manual actuation shall require a maximum force of 40 pounds (178 N) and a maximum movement of 14 inches (356 mm) to actuate the fire suppression system.

Exception: Automatic sprinkler systems shall not be required to be equipped with manual actuation means.

[F] 904.11.2 System interconnection. The actuation of the fire suppression system shall automatically shut down the fuel or electrical power supply to the cooking equipment. The fuel and electrical supply reset shall be manual.

[F] 904.11.3 Carbon dioxide systems. When carbon dioxide systems are used, there shall be a nozzle at the top of the ventilating duct. Additional nozzles that are symmetrically arranged to give uniform distribution shall be installed within vertical ducts exceeding 20 feet (6096 mm) and horizontal ducts exceeding 50 feet (15 240 mm). Dampers shall be installed at either the top or the bottom of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. Where the damper is installed at the top of the duct, the top nozzle shall be immediately below the damper. Automatic carbon dioxide fire-extinguishing systems shall be sufficiently sized to protect against all hazards venting through a common duct simultaneously.

[F] 904.11.3.1 Ventilation system. Commercial-type cooking equipment protected by an automatic carbon dioxide-extinguishing system shall be arranged to shut off the ventilation system upon activation.

[F] 904.11.4 Special provisions for automatic sprinkler systems. Automatic sprinkler systems protecting commercial-type cooking equipment shall be supplied from a separate, readily accessible, indicating-type control valve that is identified.

[F] 904.11.4.1 Listed sprinklers. Sprinklers used for the protection of fryers shall be tested in accordance with UL 199E, listed for that application and installed in accordance with their listing.

SECTION 905
STANDPIPE SYSTEMS

905.1 General. Standpipe systems shall be provided in all new buildings in which:

1. The highest floor is more than 30 feet (9144 mm) above the lowest level of fire department vehicle access; or
2. The highest floor is more than three stories above grade; or
3. The lowest floor is more than one story below grade; or
4. The lowest floor is more than 20 feet (6.1 m) below grade.

Fire hose threads used in connection with standpipe systems shall be approved and shall be compatible with fire department hose threads. The location of fire department hose connections shall be approved. In buildings used for high-piled combustible storage, fire protection shall be in accordance with the *Florida Fire Prevention Code.*

[F] 905.2 Installation standard. Standpipe systems shall be installed in accordance with this section and NFPA 14.

[F] 905.3 Required installations. Standpipe systems shall be installed where required by Sections 905.1 and 905.3.1 through 905.3.7 and in the locations indicated in Sections 905.4, 905.5 and 905.6. Standpipe systems are allowed to be combined with automatic sprinkler systems.

Exception: Standpipe systems are not required in Group R-3 occupancies.

[F] 905.3.1 Building height. Class III standpipe systems shall be installed throughout buildings where the floor level of the highest story is located more than 30 feet (9144 mm) above the lowest level of fire department vehicle access, or where the floor level of the lowest story is located more than 30 feet (9144 mm) below the highest level of fire department vehicle access. High-rise buildings shall be protected throughout by a Class I standpipe system.

Exceptions:

1. Class I standpipes are allowed in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Class I manual standpipes are allowed in open parking garages where the highest floor is located not more than 150 feet (45 720 mm) above the lowest level of fire department vehicle access.
3. Class I manual dry standpipes are allowed in open parking garages that are subject to freezing temperatures, provided that the hose connections are located as required for Class II standpipes in accordance with Section 905.5.
4. Class I standpipes are allowed in basements equipped throughout with an automatic sprinkler system.
5. In determining the lowest level of fire department vehicle access, it shall not be required to consider:

5.1. Recessed loading docks for four vehicles or less; and

5.2. Conditions where topography makes access from the fire department vehicle to the building impractical or impossible.

6. In buildings less than 75 feet (22 860 mm) in height which are protected throughout with an approved and maintained fire sprinkler system, a manual wet standpipe, as defined in NFPA 14, Standard for the Installation of Standpipe, Private Hydrant, and Hose Systems, shall be allowed.

[F] 905.3.2 Group A. Class I automatic wet standpipes shall be provided in nonsprinklered Group A buildings having an occupant load exceeding 1,000 persons.

Exceptions:

1. Open-air-seating spaces without enclosed spaces.
2. Class I automatic dry and semiautomatic dry standpipes or manual wet standpipes are allowed in buildings where the highest floor surface used for human occupancy is 75 feet (22 860 mm) or less above the lowest level of fire department vehicle access.

[F] 905.3.3 Covered mall buildings. A covered mall building shall be equipped throughout with a standpipe system where required by Section 905.3.1. Covered mall buildings not required to be equipped with a standpipe system by Section 905.3.1 shall be equipped with Class I hose connections connected to a system sized to deliver water at 250 gallons per minute (946.4 L/min) at the most hydraulically remote outlet. Hose connections shall be provided at each of the following locations:

1. Within the mall at the entrance to each exit passageway or corridor.
2. At each floor-level landing within enclosed stairways opening directly on the mall.
3. At exterior public entrances to the mall.

[F] 905.3.4 Stages. Stages greater than 1,000 square feet in area (93 m^2) shall be equipped with a Class III wet standpipe system with $1^1/_2$-inch and $2^1/_2$-inch (38 mm and 64 mm) hose connections on each side of the stage.

Exception: Where the building or area is equipped throughout with an automatic sprinkler system, a $1^1/_2$-inch (38 mm) hose connection shall be installed in accordance with NFPA 13 or in accordance with NFPA 14 for Class II or III standpipes.

[F] 905.3.4.1 Hose and cabinet. The $1^1/_2$-inch (38 mm) hose connections shall be equipped with sufficient lengths of $1^1/_2$-inch (38 mm) hose to provide fire protection for the stage area. Hose connections shall be equipped with an approved adjustable fog nozzle and be mounted in a cabinet or on a rack.

[F] 905.3.5 Underground buildings. Underground buildings shall be equipped throughout with a Class I automatic wet or manual wet standpipe system.

[F] 905.3.6 Helistops and heliports. Buildings with a helistop or heliport that are equipped with a standpipe shall extend the standpipe to the roof level on which the helistop or heliport is located in accordance with the *Florida Fire Prevention Code*.

[F] 905.3.7 Marinas and boatyards. Marinas and boatyards shall be equipped throughout with standpipe systems in accordance with NFPA 303.

[F] 905.4 Location of Class I standpipe hose connections. Class I standpipe hose connections shall be provided in all of the following locations:

1. In every required stairway, a hose connection shall be provided for each floor level above or below grade. Hose connections shall be located at an intermediate floor level landing between floors, unless otherwise approved by the fire code official.
2. On each side of the wall adjacent to the exit opening of a horizontal exit.

   Exception: Where floor areas adjacent to a horizontal exit are reachable from exit stairway hose connections by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30480 mm) of hose, a hose connection shall not be required at the horizontal exit.
3. In every exit passageway at the entrance from the exit passageway to other areas of a building.
4. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall.
5. Where the roof has a slope less than four units vertical in 12 units horizontal (33.3-percent slope), each standpipe shall be provided with a hose connection located either on the roof or at the highest landing of stairways with stair access to the roof. An additional hose connection shall be provided at the top of the most hydraulically remote standpipe for testing purposes.
6. Where the most remote portion of a nonsprinklered floor or story is more than 150 feet (45 720 mm) from a hose connection or the most remote portion of a sprinklered floor or story is more than 200 feet (60 960 mm) from a hose connection, the fire code official is authorized to require that additional hose connections be provided in approved locations.

[F] 905.4.1 Protection. Risers and laterals of Class I standpipe systems not located within an enclosed stairway or pressurized enclosure shall be protected by a degree of fire resistance equal to that required for vertical enclosures in the building in which they are located.

Exception: In buildings equipped throughout with an approved automatic sprinkler system, laterals that are not located within an enclosed stairway or pressurized enclosure are not required to be enclosed within fire-resistance-rated construction.

[F] 905.4.2 Interconnection. In buildings where more than one standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

[F] 905.5 Location of Class II standpipe hose connections. Class II standpipe hose connections shall be accessible and located so that all portions of the building are within 30 feet (9144 mm) of a nozzle attached to 100 feet (30 480 mm) of hose.

[F] 905.5.1 Groups A-1 and A-2. In Group A-1 and A-2 occupancies with occupant loads of more than 1,000, hose connections shall be located on each side of any stage, on each side of the rear of the auditorium, on each side of the balcony and on each tier of dressing rooms.

[F] 905.5.2 Protection. Fire-resistance-rated protection of risers and laterals of Class II standpipe systems is not required.

[F] 905.5.3 Class II system 1-inch hose. A minimum 1-inch (25 mm) hose shall be permitted to be used for hose stations in light-hazard occupancies where investigated and listed for this service and where approved by the fire code official.

[F] 905.6 Location of Class III standpipe hose connections. Class III standpipe systems shall have hose connections located as required for Class I standpipes in Section 905.4 and shall have Class II hose connections as required in Section 905.5.

[F] 905.6.1 Protection. Risers and laterals of Class III standpipe systems shall be protected as required for Class I systems in accordance with Section 905.4.1.

[F] 905.6.2 Interconnection. In buildings where more than one Class III standpipe is provided, the standpipes shall be interconnected at the bottom.

[F] 905.7 Cabinets. Cabinets containing fire-fighting equipment such as standpipes, fire hoses, fire extinguishers or fire department valves shall not be blocked from use or obscured from view.

[F] 905.7.1 Cabinet equipment identification. Cabinets shall be identified in an approved manner by a permanently attached sign with letters not less than 2 inches (51 mm) high in a color that contrasts with the background color, indicating the equipment contained therein.

Exceptions:

1. Doors not large enough to accommodate a written sign shall be marked with a permanently attached pictogram of the equipment contained therein.
2. Doors that have either an approved visual identification clear glass panel or a complete glass door panel are not required to be marked.

[F] 905.7.2 Locking cabinet doors. Cabinets shall be unlocked.

Exceptions:

1. Visual identification panels of glass or other approved transparent frangible material that is easily broken and allows access.
2. Approved locking arrangements.
3. Group I-3.

[F] 905.8 Dry standpipes. Dry standpipes shall not be installed.

Exception: Where subject to freezing and in accordance with NFPA 14.

[F] 905.9 Valve supervision. Valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by Section 903.4. Where a fire alarm system is provided, a signal shall also be transmitted to the control unit.

Exceptions:

1. Valves to underground key or hub valves in roadway boxes provided by the municipality or public utility do not require supervision.
2. Valves locked in the normal position and inspected as provided in this code in buildings not equipped with a fire alarm system.

[F] 905.10 During construction. Standpipe systems required during construction and demolition operations shall be provided in accordance with Section 3311.

SECTION 906
PORTABLE FIRE EXTINGUISHERS

[F] 906.1 General. Portable fire extinguishers shall be provided in occupancies and locations as required by the *Florida Fire Prevention Code*.

SECTION 907
FIRE ALARM AND DETECTION SYSTEMS

[F] 907.1 General. This section covers the application, installation, performance and maintenance of fire alarm systems and their components.

[F] 907.1.1 Construction documents. Construction documents for fire alarm systems shall be submitted for review and approval prior to system installation. Construction documents shall include, but not be limited to, all of the following:

1. A floor plan which indicates the use of all rooms.
2. Locations of alarm-initiating and notification appliances.
3. Alarm control and trouble signaling equipment.
4. Annunciation.
5. Power connection.
6. Battery calculations.
7. Conductor type and sizes.
8. Voltage drop calculations.
9. Manufacturers, model numbers and listing information for equipment, devices and materials.
10. Details of ceiling height and construction.
11. The interface of fire safety control functions.

[F] 907.1.2 Equipment. Systems and their components shall be listed and approved for the purpose for which they are installed.

907.1.3 Accessibility. Every required fire alarm system shall include a visible alarm-indicating appliance in public and common areas. For more specific accessibility requirements related to alarm-indicating appliances, refer to Section 11-4.28.

[F]907.2 Where required. An approved manual, automatic or manual and automatic fire alarm system installed in accordance with the provisions of this code and NFPA 72 shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.23 and provide occupant notification in accordance with Section 907.9, unless other requirements are provided by another section of this code. Where automatic sprinkler protection installed in accordance with Section 903.3.1.1 or 903.3.1.2 is provided and connected to the building fire alarm system, automatic heat detection required by this section shall not be required.

The automatic fire detectors shall be smoke detectors. Where ambient conditions prohibit installation of automatic smoke detection, other automatic fire detection shall be allowed.

[F]907.2.1 Group A. A manual fire alarm system shall be installed in Group A occupancies having an occupant load of 300 or more. Portions of Group E occupancies occupied for assembly purposes shall be provided with a fire alarm system as required for the Group E occupancy.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system and the alarm notification appliances will activate upon sprinkler water flow.

[F] 907.2.1.1 System initiation in Group A occupancies with an occupant load of 1,000 or more. Activation of the fire alarm in Group A occupancies with an occupant load of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system in accordance with NFPA 72.

Exception: Where approved, the prerecorded announcement is allowed to be manually deactivated for a period of time, not to exceed 3 minutes, for the sole purpose of allowing a live voice announcement from an approved, constantly attended location.

[F] 907.2.1.2 Emergency power. Emergency voice/alarm communications systems shall be provided with an approved emergency power source.

907.2.2 Group B. A fire alarm system in accordance with Section 907 shall be provided in all business occupancies where any one of the following conditions exists:

1. The building is two or more stories in height above the level of exit discharge.
2. The occupancy is subject to 50 or more occupants above or below the level of exit discharge.
3. The occupancy is subject to 300 or more total occupants.

[F] 907.2.3 Group E. A manual fire alarm system shall be installed in Group E occupancies. When automatic sprinkler systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.

Exceptions:

1. Group E occupancies with an occupant load of less than 50.
2. Manual fire alarm boxes are not required in Group E occupancies where all the following apply:
   - 2.1. Interior corridors are protected by smoke detectors with alarm verification.
   - 2.2. Auditoriums, cafeterias, gymnasiums and the like are protected by heat detectors or other approved detection devices.
   - 2.3. Shops and laboratories involving dusts or vapors are protected by heat detectors or other approved detection devices.
   - 2.4. Off-premises monitoring is provided.
   - 2.5. The capability to activate the evacuation signal from a central point is provided.
   - 2.6. In buildings where normally occupied spaces are provided with a two-way communication system between such spaces and a constantly attended receiving station from where a general evacuation alarm can be sounded, except in locations specifically designated by the fire code official.
3. Manual fire alarm boxes shall not be required in Group E occupancies where the building is equipped throughout with an approved automatic sprinkler system, the notification appliances will activate on sprinkler water flow and manual activation is provided from a normally occupied location.

907.2.4 Group F. A fire alarm system shall be required in accordance with Section 907 for industrial occupancies, unless the total capacity of the building is under 100 persons and of these fewer than 25 persons are above or below the level of exit discharge.

[F] 907.2.5 Group H. A manual fire alarm system shall be installed in Group H-5 occupancies and in occupancies used for the manufacture of organic coatings. An automatic smoke detection system shall be installed for highly toxic gases, organic peroxides and oxidizers in accordance with the *Florida Fire Prevention Code*.

[F] 907.2.6 Group I. A manual fire alarm system shall be installed in Group I occupancies. An electrically supervised, automatic smoke detection system shall be provided in accordance with Sections 907.2.6.1 and 907.2.6.2.

Exception: Manual fire alarm boxes in resident or patient sleeping areas of Group I-1 and I-2 occupancies shall not be required at exits if located at all nurses' control stations or other constantly attended staff locations, provided such stations are visible and continuously

accessible and that travel distances required in Section 907.3.1 are not exceeded.

[F] 907.2.6.1 Group I-1. Corridors, habitable spaces other than sleeping units and kitchens and waiting areas that are open to corridors shall be equipped with an automatic smoke detection system.

Exceptions:

1. Smoke detection in habitable spaces is not required where the facility is equipped throughout with an automatic sprinkler system.
2. Smoke detection is not required for exterior balconies.

[F] 907.2.6.2 Group I-2. Corridors in nursing homes (both intermediate care and skilled nursing facilities), detoxification facilities and spaces permitted to be open to the corridors by Section 407.2 shall be equipped with an automatic fire detection system. Hospitals shall be equipped with smoke detection as required in Section 407.2.

Exceptions:

1. Corridor smoke detection is not required in smoke compartments that contain patient sleeping units where patient sleeping units are provided with smoke detectors that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each patient sleeping unit and an audible and visual alarm at the nursing station attending each unit.
2. Corridor smoke detection is not required in smoke compartments that contain patient sleeping units where patient sleeping unit doors are equipped with automatic door-closing devices with integral smoke detectors on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.

[F] 907.2.6.3 Group I-3. Group I-3 occupancies shall be equipped with a manual and automatic fire alarm system installed for alerting staff.

[F] 907.2.6.3.1 System initiation. Actuation of an automatic fire-extinguishing system, a manual fire alarm box or a fire detector shall initiate an approved fire alarm signal which automatically notifies staff. Presignal systems shall not be used.

[F] 907.2.6.3.2 Manual fire alarm boxes. Manual fire alarm boxes are not required to be located in accordance with Section 907.3 where the fire alarm boxes are provided at staff-attended locations having direct supervision over areas where manual fire alarm boxes have been omitted.

Manual fire alarm boxes shall be permitted to be locked in areas occupied by detainees, provided that staff members are present within the subject area and have keys readily available to operate the manual fire alarm boxes.

[F] 907.2.6.3.3 Smoke detectors. An approved automatic smoke detection system shall be installed throughout resident housing areas, including sleeping units and contiguous day rooms, group activity spaces and other common spaces normally accessible to residents.

Exceptions:

1. Other approved smoke detection arrangements providing equivalent protection including, but not limited to, placing detectors in exhaust ducts from cells or behind protective guards listed for the purpose are allowed when necessary to prevent damage or tampering.
2. Sleeping units in Use Conditions 2 and 3.
3. Smoke detectors are not required in sleeping units with four or fewer occupants in smoke compartments that are equipped throughout with an approved automatic sprinkler system.

[F] 907.2.7 Group M. A manual fire alarm system shall be installed in Group M occupancies having an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge. The initiation of a signal from a manual fire alarm box shall initiate alarm notification appliances as required by Section 907.9.

Exceptions:

1. A manual fire alarm system is not required in covered mall buildings complying with Section 402.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system and the alarm notification appliances will automatically activate upon sprinkler water flow.

[F] 907.2.7.1 Occupant notification. During times that the building is occupied, the initiation of a signal from a manual fire alarm box or from a water flow switch shall not be required to activate the alarm notification appliances when an alarm signal is activated at a constantly attended location from which evacuation instructions shall be initiated over an emergency voice/alarm communication system installed in accordance with Section 907.2.12.2.

The emergency voice/alarm communication system shall be allowed to be used for other announcements provided the manual fire alarm use takes precedence over any other use.

[F] 907.2.8 Group R-1. Fire alarm systems shall be installed in Group R-1 occupancies as required in Sections 907.2.8.1 through 907.2.8.3.

[F] 907.2.8.1 Manual fire alarm system. A manual fire alarm system shall be installed in Group R-1 occupancies.

Exceptions:

1. A manual fire alarm system is not required in buildings not more than two stories in height where all individual sleeping units and contigu-

ous attic and crawl spaces are separated from each other and public or common areas by at least 1-hour fire partitions and each individual sleeping unit has an exit directly to a public way, exit court or yard.

2. Manual fire alarm boxes are not required throughout the building when the following conditions are met:

2.1. The building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2;

2.2. The notification appliances will activate upon sprinkler water flow; and

2.3. At least one manual fire alarm box is installed at an approved location.

[F] 907.2.8.2 Automatic fire alarm system. An automatic fire alarm system shall be installed throughout all interior corridors serving sleeping units.

Exception: An automatic fire detection system is not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exterior exit access that leads directly to an exit.

[F] 907.2.8.3 Smoke alarms. Smoke alarms shall be installed as required by Section 907.2.10. In buildings that are not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the smoke alarms in sleeping units shall be connected to an emergency electrical system and shall be annunciated by sleeping unit at a constantly attended location from which the fire alarm system is capable of being manually activated.

[F] 907.2.9 Group R-2. A manual fire alarm system shall be installed in Group R-2 occupancies where:

1. Any dwelling unit or sleeping unit is located three or more stories above the lowest level of exit discharge;
2. Any dwelling unit or sleeping unit is located more than one story below the highest level of exit discharge of exits serving the dwelling unit or sleeping unit; or
3. The building contains more than 11 dwelling units or sleeping units.

Exceptions:

1. A fire alarm system is not required in buildings not more than two stories in height where all dwelling units or sleeping units and contiguous attic and crawl spaces are separated from each other and public or common areas by at least 1-hour fire partitions and each dwelling unit or sleeping unit has an exit directly to a public way, exit court or yard.
2. Manual fire alarm boxes are not required throughout the building when the following conditions are met:

2.1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or Section 903.3.1.2; and

2.2. The notification appliances will activate upon sprinkler flow.

3. A fire alarm system is not required in buildings that do not have interior corridors serving dwelling units and are protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, provided that dwelling units either have a means of egress door opening directly to an exterior exit access that leads directly to the exits or are served by open-ended corridors designed in accordance with Section 1023.6, Exception 4.

[F] 907.2.10 Single- and multiple-station smoke alarms. Listed single- and multiple-station smoke alarms complying with UL 217 shall be installed in accordance with the provisions of this code and the household fire-warning equipment provisions of NFPA 72.

[F] 907.2.10.1 Where required. Single- or multiple-station smoke alarms shall be installed in the locations described in Sections 907.2.10.1.1 through 907.2.10.1.3.

907.2.10.1.1 Group R-1. An approved single-station smoke alarm shall be installed in every guestroom and every living area and sleeping room within a guest suite.

[F] 907.2.10.1.2 Groups R-2, R-3, R-4 and I-1. Single- or multiple-station smoke alarms shall be installed and maintained in Groups R-2, R-3, R-4 and I-1, regardless of occupant load at all of the following locations:

1. On the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms.
2. In each room used for sleeping purposes.
3. In each story within a dwelling unit, including basements but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

[F] 907.2.10.1.3 Group I-1. Single- or multiple-station smoke alarms shall be installed and maintained in sleeping areas in Group I-1 occupancies.

Exception: Single- or multiple-station smoke alarms shall not be required where the building is equipped throughout with an automatic fire detection system in accordance with Section 907.2.6.

[F] 907.2.10.2 Power source. In new construction, required smoke alarms shall receive their primary power from the building wiring where such wiring is served

from a commercial source and shall be equipped with a battery backup. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

Exception: Smoke alarms are not required to be equipped with battery backup in Group R-1 where they are connected to an emergency electrical system.

[F] 907.2.10.3 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in Group R-2, R-3 or R-4, or within an individual dwelling unit or sleeping unit in Group R-1, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

[F] 907.2.10.4 Acceptance testing. When the installation of the alarm devices is complete, each detector and interconnecting wiring for multiple-station alarm devices shall be tested in accordance with the household fire warning equipment provisions of NFPA 72.

[F] 907.2.11 Special amusement buildings. An approved automatic smoke detection system shall be provided in special amusement buildings in accordance with this section.

Exception: In areas where ambient conditions will cause a smoke detection system to alarm, an approved alternative type of automatic detector shall be installed.

[F] 907.2.11.1 Alarm. Activation of any single smoke detector, the automatic sprinkler system or any other automatic fire detection device shall immediately sound an alarm at the building at a constantly attended location from which emergency action can be initiated, including the capability of manual initiation of requirements in Section 907.2.11.2.

[F] 907.2.11.2 System response. The activation of two or more smoke detectors, a single smoke detector with alarm verification, the automatic sprinkler system or other approved fire detection device shall automatically:

1. Cause illumination of the means of egress with light of not less than 1 foot-candle (11 lux) at the walking surface level;
2. Stop any conflicting or confusing sounds and visual distractions; and
3. Activate an approved directional exit marking that will become apparent in an emergency.

   Such system response shall also include activation of a prerecorded message, clearly audible throughout the special amusement building, instructing patrons to proceed to the nearest exit. Alarm signals used in conjunction with the prerecorded message shall produce a sound which is distinctive from other sounds used during normal operation.

   The wiring to the auxiliary devices and equipment used to accomplish the above fire safety functions shall be monitored for integrity in accordance with NFPA 72.

[F] 907.2.11.3 Emergency voice/alarm communication system. An emergency voice/alarm communication system, which is also allowed to serve as a public address system, shall be installed in accordance with NFPA 72, and shall be audible throughout the entire special amusement building.

[F] 907.2.12 High-rise buildings. Buildings with a floor used for human occupancy located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall be provided with an automatic fire alarm system and an emergency voice/alarm communication system in accordance with Section 907.2.12.2.

Exceptions:

1. Airport traffic control towers in accordance with Sections 412 and 907.2.22.
2. Open parking garages in accordance with Section 406.3.
3. Buildings with an occupancy in Group A-5.
4. Low-hazard special occupancies in accordance with Section 503.1.1.
5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with Section 415.

[F] 907.2.12.1 Automatic fire detection. Smoke detectors shall be provided in accordance with this section. Smoke detectors shall be connected to an automatic fire alarm system. The activation of any detector required by this section shall operate the emergency voice/alarm communication system. Smoke detectors shall be located as follows:

1. In each mechanical equipment, electrical, transformer, telephone equipment or similar room which is not provided with sprinkler protection, elevator machine rooms and in elevator lobbies.
2. In the main return air and exhaust air plenum of each air-conditioning system having a capacity greater than 2,000 cubic feet per minute (cfm) (0.94 m^3/s). Such detectors shall be located in a serviceable area downstream of the last duct inlet.
3. At each connection to a vertical duct or riser serving two or more stories from a return air duct or plenum of an air-conditioning system. In Group R-1 and R-2 occupancies a listed smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m^3/s) and serving not more than 10 air inlet openings.

[F] 907.2.12.2 Emergency voice/alarm communication system. The operation of any automatic fire detector, sprinkler water-flow device or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving approved information and directions for a general or staged evacuation on a minimum of the alarming floor, the floor above and the floor below in accordance with the building's fire safety and evacuation

plans required by the *Florida Fire Prevention Code*. Speakers shall be provided throughout the building by paging zones. As a minimum, paging zones shall be provided as follows:

1. Elevator groups.
2. Exit stairways.
3. Each floor.
4. Areas of refuge as defined in Section 1002.1.

Exception: In Group I-1 and I-2 occupancies, the alarm shall sound in a constantly attended area and a general occupant notification shall be broadcast over the overhead page.

[F] 907.2.12.2.1 Manual override. A manual override for emergency voice communication shall be provided on a selective and all-call basis for all paging zones.

[F] 907.2.12.2.2 Live voice messages. The emergency voice/alarm communication system shall also have the capability to broadcast live voice messages through paging zones on a selective and all-call basis.

[F] 907.2.12.2.3 Standard. The emergency voice/alarm communication system shall be designed and installed in accordance with NFPA 72.

[F] 907.2.12.3 Fire department communication system. An approved two-way, fire department communication system designed and installed in accordance with NFPA 72 shall be provided for fire department use. It shall operate between a fire command center complying with Section 911 and elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside enclosed exit stairways. The fire department communication device shall be provided at each floor level within the enclosed stairway.

Exception: Fire department radio systems where approved by the fire department.

[F] 907.2.13 Atriums connecting more than two stories. A fire alarm system shall be installed in occupancies with an atrium that connects more than two stories. The system shall be activated in accordance with Section 907.6. Such occupancies in Group A, E or M shall be provided with an emergency voice/alarm communication system complying with the requirements of Section 907.2.12.2.

[F] 907.2.14 High-piled combustible storage areas. An automatic fire detection system shall be installed throughout high-piled combustible storage areas where required by the *Florida Fire Prevention Code*.

[F] 907.2.15 Delayed egress locks. Where delayed egress locks are installed on means of egress doors in accordance with Section 1008.1.8.6, an automatic smoke or heat detection system shall be installed as required by that section.

907.2.16 Aerosol storage uses. Aerosol storage rooms and general-purpose warehouses containing aerosols shall be provided with an approved manual fire alarm system where required by the *Florida Fire Prevention Code*.

[F] 907.2.17 Lumber, wood structural panel and veneer mills. Lumber, wood structural panel and veneer mills shall be provided with a manual fire alarm system.

[F] 907.2.18 Underground buildings with smoke exhaust system. Where a smoke exhaust system is installed in an underground building in accordance with this code, automatic fire detectors shall be provided in accordance with this section.

[F] 907.2.18.1 Smoke detectors. A minimum of one smoke detector listed for the intended purpose shall be installed in the following areas:

1. Mechanical equipment, electrical, transformer, telephone equipment, elevator machine or similar rooms.
2. Elevator lobbies.
3. The main return and exhaust air plenum of each air-conditioning system serving more than one story and located in a serviceable area downstream of the last duct inlet.
4. Each connection to a vertical duct or riser serving two or more floors from return air ducts or plenums of heating, ventilating and air-conditioning systems, except that in Group R occupancies, a listed smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m^3/s) and serving not more than 10 air inlet openings.

[F] 907.2.18.2 Alarm required. Activation of the smoke exhaust system shall activate an audible alarm at a constantly attended location.

[F] 907.2.19 Underground buildings. Where the lowest level of a structure is more than 60 feet (18 288 mm) below the lowest level of exit discharge, the structure shall be equipped throughout with a manual fire alarm system, including an emergency voice/alarm communication system installed in accordance with Section 907.2.12.2.

[F] 907.2.19.1 Public address system. Where a fire alarm system is not required by Section 907.2, a public address system shall be provided that shall be capable of transmitting voice communications to the highest level of exit discharge serving the underground portions of the structure and all levels below.

[F] 907.2.20 Covered mall buildings. Covered mall buildings exceeding 50,000 square feet (4645 m^2) in total floor area shall be provided with an emergency voice/alarm communication system. An emergency voice/alarm communication system serving a mall, required or otherwise, shall be accessible to the fire department. The system shall be provided in accordance with Section 907.2.12.2.

[F] 907.2.21 Residential aircraft hangars. A minimum of one listed smoke alarm shall be installed within a residential aircraft hangar as defined in Section 412.3.1 and shall be interconnected into the residential smoke alarm or other sounding device to provide an alarm that will be audible in all sleeping areas of the dwelling.

[F] 907.2.22 Airport traffic control towers. An automatic fire detection system shall be provided in airport traffic control towers.

[F] 907.2.23 Battery rooms. An approved automatic smoke detection system shall be installed in areas containing stationary storage battery systems having a liquid capacity of more than 50 gallons (189.3 L). The detection system shall be supervised by an approved central, proprietary or remote station service or a local alarm that will sound an audible signal at a constantly attended location.

[F] 907.3 Manual fire alarm boxes. Manual fire alarm boxes shall be installed in accordance with Sections 907.3.1 through 907.3.5.

[F] 907.3.1 Location. Manual fire alarm boxes shall be located not more than 5 feet (1524 mm) from the entrance to each exit. Additional manual fire alarm boxes shall be located so that travel distance to the nearest box does not exceed 200 feet (60 960 mm).

[F] 907.3.2 Height. The height of the manual fire alarm boxes shall be a minimum of 42 inches (1067 mm) and a maximum of 48 inches (1219 mm), measured vertically, from the floor level to the activating handle or lever of the box.

[F] 907.3.3 Color. Manual fire alarm boxes shall be red in color.

[F] 907.3.4 Signs. Where fire alarm systems are not monitored by a supervising station, an approved permanent sign shall be installed adjacent to each manual fire alarm box that reads: WHEN ALARM SOUNDS—CALL FIRE DEPARTMENT.

Exception: Where the manufacturer has permanently provided this information on the manual fire alarm box.

[F] 907.3.5 Protective covers. The fire code official is authorized to require the installation of listed manual fire alarm box protective covers to prevent malicious false alarms or to provide the manual fire alarm box with protection from physical damage. The protective cover shall be transparent or red in color with a transparent face to permit visibility of the manual fire alarm box. Each cover shall include proper operating instructions. A protective cover that emits a local alarm signal shall not be installed unless approved.

[F] 907.4 Power supply. The primary and secondary power supplies for the fire alarm system shall be provided in accordance with NFPA 72.

907.5 Wiring. Wiring shall comply with the requirements of Chapter 27. Wireless protection systems utilizing radio-frequency transmitting devices shall comply with the special requirements for supervision of low-power wireless systems in NFPA 72.

[F] 907.6 Activation. Where an alarm notification system is required by another section of this code, it shall be activated by:

1. A required automatic fire alarm system.
2. Sprinkler water-flow devices.
3. Required manual fire alarm boxes.

[F] 907.7 Presignal system. Presignal systems shall not be installed unless approved by the fire code official and the fire department. Where a presignal system is installed, 24-hour personnel supervision shall be provided at a location approved by the fire department, in order that the alarm signal can be actuated in the event of fire or other emergency.

[F] 907.8 Zones. Each floor shall be zoned separately and a zone shall not exceed 22,500 square feet (2090 m^2). The length of any zone shall not exceed 300 feet (91 440 mm) in any direction.

Exception: Automatic sprinkler system zones shall not exceed the area permitted by NFPA 13.

[F] 907.8.1 Zoning indicator panel. A zoning indicator panel and the associated controls shall be provided in an approved location. The visual zone indication shall lock in until the system is reset and shall not be canceled by the operation of an audible alarm-silencing switch.

[F] 907.8.2 High-rise buildings. In buildings with a floor used for human occupancy that is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access, a separate zone by floor shall be provided for all of the following types of alarm-initiating devices where provided:

1. Smoke detectors.
2. Sprinkler water-flow devices.
3. Manual fire alarm boxes.
4. Other approved types of automatic fire detection devices or suppression systems.

[F] 907.9 Alarm notification appliances. Alarm notification appliances shall be provided and shall be listed for their purpose.

[F] 907.9.1 Visible alarms. Visible alarm notification appliances shall be provided in accordance with Sections 907.9.1.1 through 907.9.1.4.

Exceptions:

1. Visible alarm notification appliances are not required in alterations, except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.
2. Visible alarm notification appliances shall not be required in exits as defined in Section 1002.1.

[F] 907.9.1.1 Public and common areas. Visible alarm notification appliances shall be provided in public areas and common areas.

[F] 907.9.1.2 Employee work areas. Where employee work areas have audible alarm coverage, the notification appliance circuits serving the employee work areas shall be initially designed with a minimum of 20 percent spare capacity to account for the potential of adding visible notification appliances in the future to accommodate hearing impaired employees.

[F] 907.9.1.3 Groups I-1 and R-1. Group I-1 and R-1 sleeping units in accordance with Table 907.9.1.3 shall be provided with a visible alarm notification appliance,

activated by both the in-room smoke alarm and the building fire alarm system.

[F] TABLE 907.9.1.3
VISIBLE AND AUDIBLE ALARMS

NUMBER OF SLEEPING UNITS	SLEEPING UNITS WITH VISIBLE AND AUDIBLE ALARMS
6 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

[F] 907.9.1.4 Group R-2. In Group R-2 occupancies required by Section 907 to have a fire alarm system, all dwelling units and sleeping units shall be provided with the capability to support visible alarm notification appliances in accordance with ICC A117.1.

[F] 907.9.2 Audible alarms. Audible alarm notification appliances shall be provided and shall sound a distinctive sound that is not to be used for any purpose other than that of a fire alarm. The audible alarm notification appliances shall provide a sound pressure level of 15 decibels (dBA) above the average ambient sound level or 5 dBA above the maximum sound level having a duration of at least 60 seconds, whichever is greater, in every occupied space within the building. The minimum sound pressure levels shall be: 70 dBA in occupancies in Groups R and I-1; 90 dBA in mechanical equipment rooms and 60 dBA in other occupancies. The maximum sound pressure level for audible alarm notification appliances shall be 120 dBA at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than 105 dBA, visible alarm notification appliances shall be provided in accordance with NFPA 72 and audible alarm notification appliances shall not be required.

Exception: Visible alarm notification appliances shall be allowed in lieu of audible alarm notification appliances in critical-care areas of Group I-2 occupancies.

907.9.3 Accessibility. Alarm systems required to be accessible by Section 11-4.1 shall comply with Section 11-4.28.

[F] 907.10 Fire safety functions. Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building's fire alarm control panel where a fire alarm system is required by Section 907.2. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or a visible and audible supervisory signal at a constantly attended location. In buildings not required to be equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with Chapter 5 of NFPA 72.

[F] 907.11 Duct smoke detectors. Duct smoke detectors shall be connected to the building's fire alarm control panel when a fire alarm system is provided. Activation of a duct smoke detector shall initiate a visible and audible supervisory signal at a constantly attended location. Duct smoke detectors shall not be used as a substitute for required open-area detection.

Exceptions:

1. The supervisory signal at a constantly attended location is not required where duct smoke detectors activate the building's alarm notification appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and audible signal in an approved location. Smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.

[F] 907.12 Access. Access shall be provided to each detector for periodic inspection, maintenance and testing.

[F] 907.13 Fire-extinguishing systems. Automatic fire-extinguishing systems shall be connected to the building fire alarm system where a fire alarm system is required by another section of this code or is otherwise installed.

907.14 Monitoring. Fire alarm systems required by this chapter or the *Florida Fire Prevention Code* shall be monitored by an approved supervising station in accordance with NFPA 72.

Exception: Supervisory service is not required for:

1. Single- and multiple-station smoke alarms required by Section 907.2.10.
2. Smoke detectors in Group I-3 occupancies.
3. Automatic sprinkler systems in one- and two-family dwellings.

[F] 907.15 Automatic telephone-dialing devices. Automatic telephone-dialing devices used to transmit an emergency alarm shall not be connected to any fire department telephone number unless approved by the fire chief.

[F] 907.16 Acceptance tests. Upon completion of the installation of the fire alarm system, alarm notification appliances and circuits, alarm-initiating devices and circuits, supervisory-signal initiating devices and circuits, signaling line circuits, and primary and secondary power supplies shall be tested in accordance with NFPA 72.

[F] 907.17 Record of completion. A record of completion in accordance with NFPA 72 verifying that the system has been installed in accordance with the approved plans and specifications shall be provided.

[F] 907.18 Instructions. Operating, testing and maintenance instructions, and record drawings ("as builts") and equipment specifications shall be provided at an approved location.

[F] 907.19 Inspection, testing and maintenance. The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with the *Florida Fire Prevention Code*.

SECTION 908
EMERGENCY ALARM SYSTEMS

[F] 908.1 Group H occupancies. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided in accordance with Section 414.7.

[F] 908.2 Group H-5 occupancy. Emergency alarms for notification of an emergency condition in an HPM facility shall be provided as required in Section 415.8.4.6. A continuous gas-detection system shall be provided for HPM gases in accordance with Section 415.8.7.

[F] 908.3 Highly toxic and toxic materials. A gas detection system shall be provided to detect the presence of gas at or below the permissible exposure limit (PEL) or ceiling limit of the gas for which detection is provided. The system shall be capable of monitoring the discharge from the treatment system at or below one-half the immediately dangerous to life and health (IDLH) limit.

Exception: A gas-detection system is not required for toxic gases when the physiological warning threshold level for the gas is at a level below the accepted PEL for the gas.

[F] 908.3.1 Alarms. The gas detection system shall initiate a local alarm and transmit a signal to a constantly attended control station when a short-term hazard condition is detected. The alarm shall be both visible and audible and shall provide warning both inside and outside the area where gas is detected. The audible alarm shall be distinct from all other alarms.

Exception: Signal transmission to a constantly attended control station is not required when not more than one cylinder of highly toxic or toxic gas is stored.

[F] 908.3.2 Shutoff of gas supply. The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for whichever gas is detected.

Exception: Automatic shutdown is not required for reactors utilized for the production of highly toxic or toxic compressed gases where such reactors are:

1. Operated at pressures less than 15 pounds per square inch gauge (psig) (103.4 kPa).
2. Constantly attended.
3. Provided with readily accessible emergency shutoff valves.

[F] 908.3.3 Valve closure. The automatic closure of shutoff valves shall be in accordance with the following:

1. When the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas room and compressed gas containers are not in gas cabinets or exhausted enclosures, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve for the compressed container of specific gas detected supplying the manifold shall automatically close.

Exception: When the gas-detection sampling point initiating the gas-detection system alarm is at a use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve in the gas valve enclosure for the branch line located in the piping distribution manifold enclosure shall automatically close.

[F] 908.4 Ozone gas-generator rooms. Ozone gas-generator rooms shall be equipped with a continuous gas-detection system that will shut off the generator and sound a local alarm when concentrations above the PEL occur.

[F] 908.5 Repair garages. A flammable-gas detection system shall be provided in repair garages for vehicles fueled by nonodorized gases in accordance with Section 406.6.6.

908.6 Refrigerant detector. Machinery rooms shall contain a refrigerant detector with an audible and visual alarm. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values for the refrigerant classification indicated in the *Florida Building Code, Mechanical.* Detectors and alarms shall be placed in approved locations.

SECTION 909
SMOKE CONTROL SYSTEMS

909.1 Scope and purpose. This section applies to mechanical or passive smoke control systems when they are required by other provisions of this code. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by this section serve a different purpose than the smoke- and heat-venting provisions found in Section 910. Mechanical smoke control systems shall not be considered exhaust systems under Chapter 5 of the *Florida Building Code, Mechanical.*

[F] 909.2 General design requirements. Buildings, structures or parts thereof required by this code to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of Section 909 and the generally accepted and well-established principles of engineering relevant to the design. The construction documents shall include sufficient information and detail to adequately describe the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied by sufficient information and analysis to demonstrate compliance with these provisions.

909.3 Special inspection and test requirements. Reserved.

[F] 909.4 Analysis. A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted construction documents and shall include, but not be limited to, the items indicated in Sections 909.4.1 through 909.4.6.

[F] 909.4.1 Stack effect. The system shall be designed such that the maximum probable normal or reverse stack effect will not adversely interfere with the system's capabilities. In determining the maximum probable stack effect, altitude, elevation, weather history and interior temperatures shall be used.

[F] 909.4.2 Temperature effect of fire. Buoyancy and expansion caused by the design fire in accordance with Section 909.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with the system's capabilities.

[F] 909.4.3 Wind effect. The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of Chapter 16.

[F] 909.4.4 HVAC systems. The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems status. The design shall consider the effects of the fire on the HVAC systems.

[F] 909.4.5 Climate. The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

[F] 909.4.6 Duration of operation. All portions of active or passive smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is less.

[F] 909.5 Smoke barrier construction. Smoke barriers shall comply with Section 709, and shall be constructed and sealed to limit leakage areas exclusive of protected openings. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls: $A/A_w = 0.00100$
2. Exit enclosures: $A/A_w = 0.00035$
3. All other shafts: $A/A_w = 0.00150$
4. Floors and roofs: $A/A_F = 0.00050$

where:

A = Total leakage area, square feet (m^2).

A_F = Unit floor or roof area of barrier, square feet (m^2).

A_w = Unit wall area of barrier, square feet (m^2).

The leakage area ratios shown do not include openings due to doors, operable windows or similar gaps. These shall be included in calculating the total leakage area.

[F] 909.5.1 Leakage area. The total leakage area of the barrier is the product of the smoke barrier gross area multiplied by the allowable leakage area ratio, plus the area of other openings such as gaps and operable windows. Compliance shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems. Passive smoke control systems tested using other approved means such as door fan testing shall be as approved by the fire code official.

[F] 909.5.2 Opening protection. Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by fire door assemblies complying with Section 715.4.3.

Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors listed for releasing service installed in accordance with Section 907.10.
2. Fixed openings between smoke zones that are protected utilizing the airflow method.
3. In Group I-2, where such doors are installed across corridors, a pair of opposite-swinging doors without a center mullion shall be installed having vision panels with fire protection-rated glazing materials in fire protection-rated frames, the area of which shall not exceed that tested. The doors shall be close-fitting within operational tolerances and shall not have undercuts, louvers or grilles. The doors shall have head and jamb stops, astragals or rabbets at meeting edges and shall be automatic-closing by smoke detection in accordance with Section 715.4.7.3. Positive-latching devices are not required.
4. Group I-3.
5. Openings between smoke zones with clear ceiling heights of 14 feet (4267 mm) or greater and bank-down capacity of greater than 20 minutes as determined by the design fire size.

[F] 909.5.2.1 Ducts and air transfer openings. Ducts and air transfer openings are required to be protected with a minimum Class II, 250°F (121°C) smoke damper complying with Section 716.

[F] 909.6 Pressurization method. The primary mechanical means of controlling smoke shall be by pressure differences across smoke barriers. Maintenance of a tenable environment is not required in the smoke control zone of fire origin.

[F] 909.6.1 Minimum pressure difference. The minimum pressure difference across a smoke barrier shall be 0.05-inch water gage (0.0124 kPa) in fully sprinklered buildings.

In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences at least two times the maximum calculated pressure difference produced by the design fire.

[F] 909.6.2 Maximum pressure difference. The maximum air pressure difference across a smoke barrier shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with Section 1008.1.2. Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by:

$$F = F_{dc} + K(WA\Delta P)/2(W - d) \quad \textbf{(Equation 9-1)}$$

where:

A = Door area, square feet (m^2).

d = Distance from door handle to latch edge of door, feet (m).

F = Total door opening force, pounds (N).

F_{dc} = Force required to overcome closing device, pounds (N).

K = Coefficient 5.2 (1.0).

W = Door width, feet (m).

ΔP = Design pressure difference, inches of water (Pa).

[F] 909.7 Airflow design method. When approved by the fire code official, smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflow shall be in accordance with this section. Airflow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects.

[F] 909.7.1 Velocity. The minimum average velocity through a fixed opening shall not be less than:

$$v = 217.2\,[h\,(T_f - T_o)/(T_f + 460)]^{1/2} \quad \textbf{(Equation 9-2)}$$

For SI: $v = 119.9\,[h\,(T_f - T_o)/T_f]^{1/2}$

where:

h = Height of opening, feet (m).

T_f = Temperature of smoke, °F (K).

T_o = Temperature of ambient air, °F (K).

v = Air velocity, feet per minute (m/minute).

[F] 909.7.2 Prohibited conditions. This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. In no case shall airflow toward the fire exceed 200 feet per minute (1.02 m/s). Where the formula in Section 909.7.1 requires airflow to exceed this limit, the airflow method shall not be used.

[F] 909.8 Exhaust method. When approved by the fire code official, mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92B.

[F] 909.8.1 Smoke layer. The height of the lowest horizontal surface of the accumulating smoke layer shall be maintained at least 6 feet (1829 mm) above any walking surface that forms a portion of a required egress system within the smoke zone.

[F] 909.9 Design fire. The design fire shall be based on a rational analysis performed by the registered design professional and approved by the fire code official. The design fire shall be based on the analysis in accordance with Section 909.4 and this section.

[F] 909.9.1 Factors considered. The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire and whether the fire is likely to be steady or unsteady.

[F] 909.9.2 Separation distance. Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration.

$$R = [Q/(12\pi q'')]^{1/2} \quad \textbf{(Equation 9-8)}$$

where:

q'' = Incident radiant heat flux required for nonpiloted ignition, Btu/ft^2 · s(W/m^2).

Q = Heat release from fire, Btu/s (kW).

R = Separation distance from target to center of fuel package, feet (m).

[F] 909.9.3 Heat-release assumptions. The analysis shall make use of best available data from approved sources and shall not be based on excessively stringent limitations of combustible material.

[F] 909.9.4 Sprinkler effectiveness assumptions. A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

[F] 909.10 Equipment. Equipment including, but not limited to, fans, ducts, automatic dampers and balance dampers, shall be suitable for its intended use, suitable for the probable exposure temperatures that the rational analysis indicates and as approved by the fire code official.

[F] 909.10.1 Exhaust fans. Components of exhaust fans shall be rated and certified by the manufacturer for the probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

$$T_s = (Q_c/mc) + (T_a) \quad \textbf{(Equation 9-3)}$$

where:

c = Specific heat of smoke at smoke layer temperature, Btu/lb°F (kJ/kg · K).

m = Exhaust rate, pounds per second (kg/s).

Q_c = Convective heat output of fire, Btu/s (kW).

T_a = Ambient temperature, °F (K).

T_s = Smoke temperature, °F (K).

Exception: Reduced T_s as calculated based on the assurance of adequate dilution air.

909.10.2 Ducts. Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with Section 909.10.1. Ducts shall be constructed and supported in accordance with the *Florida Building Code, Mechanical.* Ducts shall be leak tested to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5 percent of design flow. Results of such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

Exception: Flexible connections (for the purpose of vibration isolation) complying with the *Florida Building Code, Mechanical* that are constructed of approved fire-resistance-rated materials.

[F] 909.10.3 Equipment, inlets and outlets. Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outside air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

[F] 909.10.4 Automatic dampers. Automatic dampers, regardless of the purpose for which they are installed within the smoke control system, shall be listed and conform to the requirements of approved, recognized standards.

[F] 909.10.5 Fans. In addition to other requirements, belt-driven fans shall have 1.5 times the number of belts required for the design duty, with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the requirements of Chapter 16. Motors driving fans shall not be operated beyond their nameplate horsepower (kilowatts), as determined from measurement of actual current draw, and shall have a minimum service factor of 1.15.

909.11 Power systems. The smoke control system shall be supplied with two sources of power. Primary power shall be from the normal building power systems. Secondary power shall be from an approved standby source complying with Chapter 27 of the *Florida Building Code, Building.* The standby power source and its transfer switches shall be in a separate room from the normal power transformers and switch gear and shall be enclosed in a room constructed of not less than 1-hour fire-resistance-rated fire barriers ventilated directly to and from the exterior. Power distribution from the two sources shall be by independent routes. Transfer to full standby power shall be automatic and within 60 seconds of failure of the primary power. The systems shall comply with Chapter 27 of the *Florida Building Code, Building.*

[F] 909.11.1 Power sources and power surges. Elements of the smoke management system relying on volatile memories or the like shall be supplied with uninterruptable power sources of sufficient duration to span a 15-minute primary power interruption. Elements of the smoke management system susceptible to power surges shall be suitably protected by conditioners, suppressors or other approved means.

[F] 909.12 Detection and control systems. Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Section 907. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control equipment.

Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override, the presence of power downstream of all disconnects and, through a preprogrammed weekly test sequence, report abnormal conditions audibly, visually and by printed report.

909.12.1 Wiring. In addition to meeting requirements of Chapter 27 of the *Florida Building Code, Building*, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

[F] 909.12.2 Activation. Smoke control systems shall be activated in accordance with this section.

[F] 909.12.2.1 Pressurization, airflow or exhaust method. Mechanical smoke control systems using the pressurization, airflow or exhaust method shall have completely automatic control.

[F] 909.12.2.2 Passive method. Passive smoke control systems actuated by approved spot-type detectors listed for releasing service shall be permitted.

[F] 909.12.3 Automatic control. Where completely automatic control is required or used, the automatic-control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with Section 903.3.1.1, manual controls that are readily accessible to the fire department and any smoke detectors required by engineering analysis.

[F] 909.13 Control air tubing. Control air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections and shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

[F] 909.13.1 Materials. Control air tubing shall be hard drawn copper, Type L, ACR in accordance with ASTM B 42, ASTM B 43, ASTM B 68, ASTM B 88, ASTM B 251 and ASTM B 280. Fittings shall be wrought copper or brass, solder type, in accordance with ASME B 16.18 or ASME B 16.22. Changes in direction shall be made with appropriate tool bends. Brass compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP5 brazing alloy with solidus above 1,100°F (593°C) and liquids below 1,500°F (816°C). Brazing flux shall be used on copper-to-brass joints only.

Exception: Nonmetallic tubing used within control panels and at the final connection to devices, provided that all of the following conditions are met:

1. Tubing shall be listed by an approved agency for flame and smoke characteristics.
2. Tubing and connected devices shall be completely enclosed within galvanized or paint-grade steel enclosure of not less than 0.030 inch (0.76 mm) (No. 22 galvanized sheet gage) thickness. Entry to the enclosure shall be by copper tubing with a protective grommet of neoprene or teflon or by suitable brass compression to male-barbed adapter.
3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within enclosure. Tubing bridging cabinet and door or moveable device shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing serving devices on doors shall be fastened along hinges.

[F] 909.13.2 Isolation from other functions. Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

[F] 909.13.3 Testing. Control air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

[F] 909.14 Marking and identification. The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

[F] 909.15 Control diagrams. Identical control diagrams showing all devices in the system and identifying their location and function shall be maintained current and kept on file with the fire code official, the fire department and in the fire command center in a format and manner approved by the fire chief.

909.16 Fire-fighter's smoke control panel. A fire-fighter's smoke control panel for fire department emergency response purposes only shall be provided and shall include manual control or override of automatic control for mechanical smoke control systems. The panel shall be located in a fire command center complying with Section 911 in high-rise buildings or buildings with smoke protected assembly seating. In other buildings, the fire-fighter's smoke control panel shall be installed in an approved location adjacent to the fire alarm control panel. The fire-fighter's smoke control panel shall comply with Sections 909.16.1 through 909.16.3.

[F] 909.16.1 Smoke control systems. Fans within the building shall be shown on the fire-fighter's control panel. A clear indication of the direction of airflow and the relationship of components shall be displayed. Status indicators shall be provided for all smoke control equipment, annunciated by fan and zone, and by pilot-lamp-type indicators as follows:

1. Fans, dampers and other operating equipment in their normal status—WHITE.
2. Fans, dampers and other operating equipment in their off or closed status—RED.
3. Fans, dampers and other operating equipment in their on or open status—GREEN.
4. Fans, dampers and other operating equipment in a fault status—YELLOW/AMBER.

[F] 909.16.2 Smoke control panel. The fire-fighter's control panel shall provide control capability over the complete smoke-control system equipment within the building as follows:

1. ON-AUTO-OFF control over each individual piece of operating smoke control equipment that can also be controlled from other sources within the building. This includes stairway pressurization fans; smoke exhaust fans; supply, return and exhaust fans; elevator shaft fans and other operating equipment used or intended for smoke control purposes.
2. OPEN-AUTO-CLOSE control over individual dampers relating to smoke control and that are also controlled from other sources within the building.
3. ON-OFF or OPEN-CLOSE control over smoke control and other critical equipment associated with a fire or smoke emergency and that can only be controlled from the fire-fighter's control panel.

Exceptions:

1. Complex systems, where approved, where the controls and indicators are combined to control and indicate all elements of a single smoke zone as a unit.
2. Complex systems, where approved, where the control is accomplished by computer interface using approved, plain English commands.

909.16.3 Control action and priorities. The fire-fighter's control panel actions shall be as follows:

1. ON-OFF, OPEN-CLOSE control actions shall have the highest priority of any control point within the building. Once issued from the fire-fighter's control panel, no automatic or manual control from any other control point within the building shall contradict the control action. Where automatic means are provided to interrupt normal, nonemergency equipment operation or produce a specific result to safeguard the building or equipment (i.e., duct freezestats, duct smoke detectors, high-temperature cutouts, temperature-actuated linkage and similar devices), such means shall be capable of being overridden by the fire-fighter's control panel. The last control action as indicated by each fire-fighter's control panel switch position shall prevail. In no case shall control actions require the smoke control system to assume more than one configuration at any one time.

   Exception: Power disconnects required by Chapter 27 of the *Florida Building Code, Building.*
2. Only the AUTO position of each three-position fire-fighter's control panel switch shall allow auto-

matic or manual control action from other control points within the building. The AUTO position shall be the NORMAL, nonemergency, building control position. Where a fire-fighter's control panel is in the AUTO position, the actual status of the device (on, off, open, closed) shall continue to be indicated by the status indicator described above. When directed by an automatic signal to assume an emergency condition, the NORMAL position shall become the emergency condition for that device or group of devices within the zone. In no case shall control actions require the smoke control system to assume more than one configuration at any one time.

[F] 909.17 System response time. Smoke-control system activation shall be initiated immediately after receipt of an appropriate automatic or manual activation command. Smoke control systems shall activate individual components (such as dampers and fans) in the sequence necessary to prevent physical damage to the fans, dampers, ducts and other equipment. For purposes of smoke control, the fire-fighter's control panel response time shall be the same for automatic or manual smoke control action initiated from any other building control point. The total response time, including that necessary for detection, shutdown of operating equipment and smoke control system startup, shall allow for full operational mode to be achieved before the conditions in the space exceed the design smoke condition. The system response time for each component and their sequential relationships shall be detailed in the required rational analysis and verification of their installed condition reported in the required final report.

[F] 909.18 Acceptance testing. Devices, equipment, components and sequences shall be individually tested. These tests, in addition to those required by other provisions of this code, shall consist of determination of function, sequence and, where applicable, capacity of their installed condition.

[F] 909.18.1 Detection devices. Smoke or fire detectors that are a part of a smoke control system shall be tested in accordance with Chapter 9 in their installed condition. When applicable, this testing shall include verification of airflow in both minimum and maximum conditions.

[F] 909.18.2 Ducts. Ducts that are part of a smoke control system shall be traversed using generally accepted practices to determine actual air quantities.

[F] 909.18.3 Dampers. Dampers shall be tested for function in their installed condition.

[F] 909.18.4 Inlets and outlets. Inlets and outlets shall be read using generally accepted practices to determine air quantities.

[F] 909.18.5 Fans. Fans shall be examined for correct rotation. Measurements of voltage, amperage, revolutions per minute (rpm) and belt tension shall be made.

[F] 909.18.6 Smoke barriers. Measurements using inclined manometers or other approved calibrated measuring devices shall be made of the pressure differences across smoke barriers. Such measurements shall be conducted for each possible smoke control condition.

[F] 909.18.7 Controls. Each smoke zone, equipped with an automatic-initiation device, shall be put into operation by the actuation of one such device. Each additional device within the zone shall be verified to cause the same sequence without requiring the operation of fan motors in order to prevent damage. Control sequences shall be verified throughout the system, including verification of override from the fire-fighter's control panel and simulation of standby power conditions.

[F] 909.18.8 Special inspections for smoke control. Smoke control systems shall be tested by a special inspector.

[F] 909.18.8.1 Scope of testing. Special inspections shall be conducted in accordance with the following:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure-difference testing, flow measurements, and detection and control verification.

[F] 909.18.8.2 Qualifications. Special inspection agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

[F] 909.18.8.3 Reports. A complete report of testing shall be prepared by the special inspector or special inspection agency. The report shall include identification of all devices by manufacturer, nameplate data, design values, measured values and identification tag or mark. The report shall be reviewed by the responsible registered design professional and, when satisfied that the design intent has been achieved, the responsible registered design professional shall seal, sign and date the report.

[F] 909.18.8.3.1 Report filing. A copy of the final report shall be filed with the fire code official and an identical copy shall be maintained in an approved location at the building.

[F] 909.18.9 Identification and documentation. Charts, drawings and other documents identifying and locating each component of the smoke control system, and describing its proper function and maintenance requirements, shall be maintained on file at the building as an attachment to the report required by Section 909.18.8.3. Devices shall have an approved identifying tag or mark on them consistent with the other required documentation and shall be dated indicating the last time they were successfully tested and by whom.

[F] 909.19 System acceptance. Buildings, or portions thereof, required by this code to comply with this section shall not be issued a certificate of occupancy until such time that the fire code official determines that the provisions of this section have been fully complied with and that the fire department has received satisfactory instruction on the operation, both automatic and manual, of the system.

Exception: In buildings of phased construction, a temporary certificate of occupancy, as approved by the fire code

official, shall be allowed provided that those portions of the building to be occupied meet the requirements of this section and that the remainder does not pose a significant hazard to the safety of the proposed occupants or adjacent buildings.

909.20 Smokeproof enclosures. Where required by Section 1020.1.7, a smokeproof enclosure shall be constructed in accordance with this section. A smokeproof enclosure shall consist of an enclosed interior exit stairway that conforms to Section 1020.1 and an open exterior balcony or ventilated vestibule meeting the requirements of this section. Where access to the roof is required by the *Florida Fire Prevention Code*, such access shall be from the smokeproof enclosure where a smokeproof enclosure is required.

909.20.1 Access. Access to the stair shall be by way of a vestibule or an open exterior balcony. The minimum dimension of the vestibule shall not be less than the required width of the corridor leading to the vestibule but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.

909.20.2 Construction. The smokeproof enclosure shall be separated from the remainder of the building by not less than a 2-hour fire barrier without openings other than the required means of egress doors. The vestibule shall be separated from the stairway by not less than a 2-hour fire barrier. The open exterior balcony shall be constructed in accordance with the fire-resistance-rating requirements for floor construction.

909.20.2.1 Door closers. Doors in a smokeproof enclosure shall be self- or automatic closing by actuation of a smoke detector in accordance with Section 715.4 and shall be installed at the floor-side entrance to the smokeproof enclosure. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the smokeproof enclosure at all levels. Smoke detectors shall be installed in accordance with Section 907.10.

909.20.3 Natural ventilation alternative. The provisions of Sections 909.20.3.1 through 909.20.3.3 shall apply to ventilation of smokeproof enclosures by natural means.

909.20.3.1 Balcony doors. Where access to the stairway is by way of an open exterior balcony, the door assembly into the enclosure shall be a fire door assembly in accordance with Section 715.4.

909.20.3.2 Vestibule doors. Where access to the stairway is by way of a vestibule, the door assembly into the vestibule shall be a fire door assembly complying with Section 715.4. The door assembly from the vestibule to the stairway shall have not less than a 20-minute fire protection rating complying with Section 715.4.

909.20.3.3 Vestibule ventilation. Each vestibule shall have a minimum net area of 16 square feet (1.5 m^2) of opening in a wall facing an outer court, yard or public way that is at least 20 feet (6096 mm) in width.

909.20.4 Mechanical ventilation alternative. The provisions of Sections 909.20.4.1 through 909.20.4.4 shall apply to ventilation of smokeproof enclosures by mechanical means.

909.20.4.1 Vestibule doors. The door assembly from the building into the vestibule shall be a fire door assembly complying with Section 715.4.3. The door assembly from the vestibule to the stairway shall not have less than a 20-minute fire protection rating and meet the requirements for a smoke door assembly in accordance with Section 715.4.3. The door shall be installed in accordance with NFPA 105.

909.20.4.2 Vestibule ventilation. The vestibule shall be supplied with not less than one air change per minute and the exhaust shall not be less than 150 percent of supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within 6 inches (152 mm) of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than 6 inches (152 mm) down from the top of the trap, and shall be entirely within the smoke trap area. Doors in the open position shall not obstruct duct openings. Duct openings with controlling dampers are permitted where necessary to meet the design requirements, but dampers are not otherwise required.

909.20.4.2.1 Engineered ventilation system. Where a specially engineered system is used, the system shall exhaust a quantity of air equal to not less than 90 air changes per hour from any vestibule in the emergency operation mode and shall be sized to handle three vestibules simultaneously. Smoke detectors shall be located at the floor-side entrance to each vestibule and shall activate the system for the affected vestibule. Smoke detectors shall be installed in accordance with Section 907.10.

909.20.4.3 Smoke trap. The vestibule ceiling shall be at least 20 inches (508 mm) higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward-moving air column. The height shall not be decreased unless approved and justified by design and test.

909.20.4.4 Stair shaft air movement system. The stair shaft shall be provided with a dampered relief opening and supplied with sufficient air to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) in the shaft relative to the vestibule with all doors closed.

909.20.5 Stair pressurization alternative. Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the vestibule is not required, provided that interior exit stairways are pressurized to a minimum of 0.05 inch of water (12.3 Pa) and a maximum of 0.35 inch of water (87 Pa) in the shaft relative to the building measured with all stairway doors closed under maximum anticipated stack pressures.

909.20.6 Ventilating equipment. The activation of ventilating equipment required by the alternatives in Sections 909.20.4 and 909.20.5 shall be by smoke detectors installed

at each floor level at an approved location at the entrance to the smokeproof enclosure. When the closing device for the stair shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section 907.10.

909.20.6.1 Ventilation systems. Smokeproof enclosure ventilation systems shall be independent of other building ventilation systems. The equipment and ductwork shall comply with one of the following:

1. Equipment and ductwork shall be located exterior to the building and directly connected to the smokeproof enclosure or connected to the smokeproof enclosure by ductwork enclosed by 2-hour fire barriers.
2. Equipment and ductwork shall be located within the smokeproof enclosure with intake or exhaust directly from and to the outside or through ductwork enclosed by 2-hour fire barriers.
3. Equipment and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by 2-hour fire barriers.

909.20.6.2 Standby power. Mechanical vestibule and stair shaft ventilation systems and automatic fire detection systems shall be powered by an approved standby power system conforming to Section 403.10.1 and Chapter 27.

909.20.6.3 Acceptance and testing. Before the mechanical equipment is approved, the system shall be tested in the presence of the building official to confirm that the system is operating in compliance with these requirements.

SECTION 910
SMOKE AND HEAT VENTS

[F] 910.1 General. Where required by this code or otherwise installed, smoke and heat vents, or mechanical smoke exhaust systems, and draft curtains shall conform to the requirements of this section.

Exceptions:

1. Frozen food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.
2. Where areas of buildings are equipped with early suppression fast-response (ESFR) sprinklers, automatic smoke and heat vents shall not be required within these areas.

[F] 910.2 Where required. Smoke and heat vents shall be installed in the roofs of one-story buildings or portions thereof occupied for the uses set forth in Sections 910.2.1 through 910.2.3.

[F] 910.2.1 Group F-1 or S-1. Buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet (4645 m^2) in undivided area.

Exception: Group S-1 aircraft repair hangars.

[F] 910.2.2 High-piled combustible storage. Buildings and portions thereof containing high-piled combustible stock or rack storage in any occupancy group in accordance with Section 413 and the *Florida Fire Prevention Code.*

[F] 910.2.3 Exit access travel distance increase. Buildings and portions thereof used as a Group F-1 or S-1 occupancy where the maximum exit access travel distance is increased in accordance with Section 1016.2.

[F] 910.3 Design and installation. The design and installation of smoke and heat vents and draft curtains shall be as specified in Sections 910.3.1 through 910.3.5.2 and Table 910.3.

[F] 910.3.1 Design. Smoke and heat vents shall be listed and labeled to indicate compliance with UL 793.

[F] 910.3.2 Vent operation. Smoke and heat vents shall be capable of being operated by approved automatic and manual means. Automatic operation of smoke and heat vents shall conform to the provisions of Sections 910.3.2.1 through 910.3.2.3.

[F] 910.3.2.1 Gravity-operated drop-out vents. Automatic smoke and heat vents containing heat-sensitive glazing designed to shrink and drop out of the vent opening when exposed to fire shall fully open within 5 minutes after the vent cavity is exposed to a simulated fire, represented by a time-temperature gradient that reaches an air temperature of 500°F (260°C) within 5 minutes.

[F] 910.3.2.2 Sprinklered buildings. Where installed in buildings provided with an approved automatic sprinkler system, smoke and heat vents shall be designed to operate automatically.

[F] 910.3.2.3 Nonsprinklered buildings. Where installed in buildings not provided with an approved automatic sprinkler system, smoke and heat vents shall operate automatically by actuation of a heat-responsive device rated at between 100°F (38°C) and 220°F (104°C) above ambient.

Exception: Gravity-operated drop-out vents complying with Section 910.3.2.1

[F] 910.3.3 Vent dimensions. The effective venting area shall not be less than 16 square feet (1.5 m^2) with no dimension less than 4 feet (1219 mm), excluding ribs or gutters having a total width not exceeding 6 inches (152 mm).

[F] 910.3.4 Vent locations. Smoke and heat vents shall be located 20 feet (6096 mm) or more from adjacent lot lines and fire walls and 10 feet (3048 mm) or more from fire barrier walls. Vents shall be uniformly located within the roof area above high-piled storage areas, with consideration given to roof pitch, draft curtain location, sprinkler location and structural members.

[F] 910.3.5 Draft curtains. Where required by Table 910.3, draft curtains shall be provided in accordance with this section.

Exception: Where areas of buildings are equipped with ESFR sprinklers, draft curtains shall not be provided within these areas. Draft curtains shall only be provided at the separation between the ESFR sprinklers and the conventional sprinklers.

[F] 910.3.5.1 Construction. Draft curtains shall be constructed of sheet metal, lath and plaster, gypsum board or other approved materials which provide equivalent performance to resist the passage of smoke. Joints and connections shall be smoke tight.

[F] 910.3.5.2 Location and depth. The location and minimum depth of draft curtains shall be in accordance with Table 910.3.

[F] 910.4 Mechanical smoke exhaust. Where approved by the fire code official, engineered mechanical smoke exhaust shall be an acceptable alternate to smoke and heat vents.

[F] 910.4.1 Location. Exhaust fans shall be uniformly spaced within each draft-curtained area and the maximum distance between fans shall not be greater than 100 feet (30 480 mm).

[F] 910.4.2 Size. Fans shall have a maximum individual capacity of 30,000 cfm (14.2 m^3/s). The aggregate capacity of smoke exhaust fans shall be determined by the equation:

$$C = A \times 300 \qquad \textbf{(Equation 9-4)}$$

where:

C = Capacity of mechanical ventilation required, in cubic feet per minute (m^3/s).

A = Area of roof vents provided in square feet (m^2) in accordance with Table 910.3.

[F] 910.4.3 Operation. Mechanical smoke exhaust fans shall be automatically activated by the automatic sprinkler system or by heat detectors having operating characteristics equivalent to those described in Section 910.3.2. Individual manual controls of each fan unit shall also be provided.

[F] 910.4.4 Wiring and control. Wiring for operation and control of smoke exhaust fans shall be connected ahead of the main disconnect and protected against exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes. Controls shall be located so as to be immediately accessible to the fire service from the exterior of the building and protected against interior fire exposure by fire barriers having a fire-resistance rating not less than 1 hour.

[F] 910.4.5 Supply air. Supply air for exhaust fans shall be provided at or near the floor level and shall be sized to provide a minimum of 50 percent of required exhaust. Open-

[F] TABLE 910.3
REQUIREMENTS FOR DRAFT CURTAINS AND SMOKE AND HEAT VENTS[a]

OCCUPANCY GROUP AND COMMODITY CLASSIFICATION	DESIGNATED STORAGE HEIGHT (feet)	MINIMUM DRAFT CURTAIN DEPTH (feet)	MAXIMUM AREA FORMED BY DRAFT CURTAINS (square feet)	VENT-AREA-TO-FLOOR-AREA RATIO[c]	MAXIMUM SPACING OF VENT CENTERS (feet)	MAXIMUM DISTANCE TO VENTS FROM WALL OR DRAFT CURTAINS[b] (feet)
Group F-1 and S-1	—	0.2 × H[d] but ≥ 4	50,000	1:100	120	60
High-piled Storage (see Section 910.2.2) I-IV (Option 1)	≤ 20	6	10,000	1:100	100	60
	> 20 ≤ 40	6	8,000	1:75	100	55
High-piled Storage (see Section 910.2.2) I-IV (Option 2)	≤ 20	4	3,000	1:75	100	55
	> 20 ≤ 40	4	3,000	1:50	100	50
High-piled Storage (see Section 910.2.2) High hazard (Option 1)	≤ 20	6	6,000	1:50	100	50
	> 20 ≤ 30	6	6,000	1:40	90	45
High-piled Storage (see Section 910.2.2) High hazard (Option 2)	≤ 20	4	4,000	1:50	100	50
	> 20 ≤ 30	4	2,000	1:30	75	40

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Requirements for rack storage heights in excess of those indicated shall be in accordance with the *Florida Fire Prevention Code*. For solid-piled storage heights in excess of those indicated, an approved engineered design shall be used.

b. The distance specified is the maximum distance from any vent in a particular draft curtained area to walls or draft curtains which form the perimeter of the draft curtained area.

c. Where draft curtains are not required, the vent-area-to-floor-area ratio shall be calculated based on a minimum draft curtain depth of 6 feet (Option 1).

d. "H" is the height of the vent, in feet, above the floor.

ings for supply air shall be uniformly distributed around the periphery of the area served.

[F] 910.4.6 Interlocks. In combination comfort air-handling/smoke removal systems or independent comfort air-handling systems, fans shall be controlled to shut down in accordance with the approved smoke control sequence.

SECTION 911
FIRE COMMAND CENTER

[F] 911.1 Features. Where required by other sections of this code, a fire command center for fire department operations shall be provided. The location and accessibility of the fire command center shall be approved by the fire department. The fire command center shall be separated from the remainder of the building by not less than a 1-hour fire barrier constructed in accordance with Section 706 or horizontal assembly constructed in accordance with Section 711, or both. The room shall be a minimum of 96 square feet (9 m^2) with a minimum dimension of 8 feet (2438 mm). A layout of the fire command center and all features required by the section to be contained therein shall be submitted for approval prior to installation. The fire command center shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system unit.
2. The fire department communications unit.
3. Fire detection and alarm system annunciator unit.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air-handling systems.
6. The fire-fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking stairway doors simultaneously.
8. Sprinkler valve and water-flow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire-fighting equipment and fire department access.
13. Worktable.
14. Generator supervision devices, manual start and transfer features.
15. Public address system, where specifically required by other sections of this code.

SECTION 912
FIRE DEPARTMENT CONNECTIONS

[F] 912.1 Installation. Fire department connections shall be installed in accordance with the NFPA standard applicable to the system design and shall comply with Sections 912.2 through 912.5.

[F] 912.2 Location. With respect to hydrants, driveways, buildings and landscaping, fire department connections shall be so located that fire apparatus and hose connected to supply the system will not obstruct access to the buildings for other fire apparatus. The location of fire department connections shall be approved.

[F] 912.2.1 Visible location. Fire department connections shall be located on the street side of buildings, fully visible and recognizable from the street or nearest point of fire department vehicle access or as otherwise approved by the fire code official.

[F] 912.2.2 Existing buildings. On existing buildings, wherever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an approved sign mounted on the street front or on the side of the building. Such sign shall have the letters "FDC" at least 6 inches (152 mm) high and words in letters at least 2 inches (51 mm) high or an arrow to indicate the location. All such signs shall be subject to the approval of the fire code official.

[F] 912.3 Access. Immediate access to fire department connections shall be maintained at all times and without obstruction by fences, bushes, trees, walls or any other object for a minimum of 3 feet (914 mm).

[F] 912.3.1 Locking fire department connection caps. The fire code official is authorized to require locking caps on fire department connections for water-based fire protection systems where the responding fire department carries appropriate key wrenches for removal.

[F] 912.4 Signs. A metal sign with raised letters at least 1 inch (25 mm) in size shall be mounted on all fire department connections serving automatic sprinklers, standpipes or fire pump connections. Such signs shall read: AUTOMATIC SPRINKLERS, STANDPIPES or TEST CONNECTION, or a combination thereof as applicable.

[P] 912.5 Backflow protection. The potable water supply to automatic sprinkler and standpipe systems shall be protected against backflow as required by the *Florida Building Code, Plumbing.*

CHAPTER 10
MEANS OF EGRESS

SECTION 1001
ADMINISTRATION

1001.1 General. Buildings or portions thereof shall be provided with a means of egress system as required by this chapter. The provisions of this chapter shall control the design, construction and arrangement of means of egress components required to provide an approved means of egress from structures and portions thereof.

1001.2 Minimum requirements. It shall be unlawful to alter a building or structure in a manner that will reduce the number of exits or the capacity of the means of egress to less than required by this code.

1001.3 Maintenance. Means of egress shall be maintained in accordance with the *Florida Fire Prevention Code*.

1001.4 Alterations. A building shall not hereafter be altered to reduce the capacity of the means of egress to less than required by this chapter nor shall any change of occupancy be made in any building unless such building conforms to the requirements of this chapter.

> **Exception:** Existing stairs shall be permitted to remain in use provided they comply with the requirements of the building code in effect at the time of original construction.

1001.5 Where approved by the building official, existing stairs shall be permitted to be rebuilt in accordance with the dimensional criteria of the building code in effect at the time of original construction provided:

1. Handrails comply with Section 1009.11, and,
2. Guardrails comply with Section 1012, and,
3. The elevation of the floor surfaces on both sides of the door complies with Section 1008.1.4.

1001.6 Special egress requirements by occupancy. The general requirements of Chapter 10 apply to all occupancies except as modified for specific occupancies in accordance with Section 1024 and Sections 1026 through 1033.

SECTION 1002
DEFINITIONS

1002.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

ACCESSIBLE MEANS OF EGRESS. A continuous and unobstructed way of egress travel from any accessible point in a building or facility to a public way.

AISLE. An exit access component that defines and provides a path of egress travel.

AISLE ACCESSWAY. That portion of an exit access that leads to an aisle.

ALTERNATING TREAD DEVICE. A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

AREA OF REFUGE. An area where persons unable to use stairways can remain temporarily to await instructions or assistance during emergency evacuation.

BLEACHERS. Tiered seating facilities.

CIRCULAR STAIRS. A stairway with steps that result in a sweeping circular or curved pattern, but not spiral stairs.

COMMON PATH OF EGRESS TRAVEL. That portion of exit access which the occupants are required to traverse before two separate and distinct paths of egress travel to two exits are available. Paths that merge are common paths of travel. Common paths of egress travel shall be included within the permitted travel distance.

CORRIDOR. An enclosed exit access component that defines and provides a path of egress travel to an exit.

DOOR, BALANCED. A door equipped with double-pivoted hardware so designed as to cause a semicounterbalanced swing action when opening.

EGRESS COURT. A court or yard which provides access to a public way for one or more exits.

EMERGENCY ESCAPE AND RESCUE OPENING. An operable window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

EXIT. That portion of a means of egress system which is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives as required to provide a protected path of egress travel between the exit access and the exit discharge. Exits include exterior exit doors at ground level, exit enclosures, exit passageways, exterior exit stairs, exterior exit ramps and horizontal exits.

EXIT, HORIZONTAL. A path of egress travel from one building to an area in another building on approximately the same level, or a path of egress travel through or around a wall or partition to an area on approximately the same level in the same building, which affords safety from fire and smoke from the area of incidence and areas communicating therewith.

EXIT ACCESS. That portion of a means of egress system that leads from any occupied portion of a building or structure to an exit.

EXIT DISCHARGE. That portion of a means of egress system between the termination of an exit and a public way.

EXIT DISCHARGE, LEVEL OF. The lowest level having at least 50 percent of the number of exits and capacity of exits discharging to the exterior at grade or story with the least change in elevation to grade, provided no other story has 50 percent of

its exits or egress capacity discharging to the exterior at the grade.

EXIT ENCLOSURE. An exit component that is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a vertical or horizontal direction to the exit discharge or the public way.

EXIT PASSAGEWAY. An exit component that is separated from all other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to the exit discharge or the public way.

FIRE EXIT HARDWARE. Panic hardware that is listed for use on fire door assemblies.

FLOOR AREA, GROSS. The floor area within the inside perimeter of the exterior walls of the building under consideration, exclusive of vent shafts and courts, without deduction for corridors, stairways, closets, the thickness of interior walls, columns or other features. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above. The gross floor area shall not include shafts with no openings or interior courts.

FLOOR AREA, NET. The actual occupied area not including unoccupied accessory areas such as corridors, stairways, toilet rooms, mechanical rooms and closets.

FOLDING AND TELESCOPIC SEATING. Tiered seating facilities having an overall shape and size that are capable of being reduced for purposes of moving or storing.

GRANDSTAND. Tiered seating facilities.

GUARD. A building component or a system of building components located at or near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to a lower level.

HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

MEANS OF EGRESS. A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way. A means of egress consists of three separate and distinct parts: the exit access, the exit and the exit discharge.

MEANS OF ESCAPE. A way out of a building or structure that does not conform to the strict definition of means of egress but does provide an alternate way out. A means of escape consists of a door, stairway, passage or hall providing a way of unobstructed travel to the outside at street or ground level that is independent of and remotely located from the means of egress. It may also consist of a passage through an adjacent nonlockable space, independent of and remotely located from the means of egress, to any approved exit.

MERCHANDISE PAD. A merchandise pad is an area for display of merchandise surrounded by aisles, permanent fixtures or walls. Merchandise pads contain elements such as nonfixed and moveable fixtures, cases, racks, counters and partitions as indicated in Section 105.2 from which customers browse or shop.

NOSING. The leading edge of treads of stairs and of landings at the top of stairway flights.

OCCUPANT LOAD. The number of persons for which the means of egress of a building or portion thereof is designed.

PANIC HARDWARE. A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel.

PUBLIC WAY. A street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and which has a clear width and height of not less than 10 feet (3048 mm).

RAMP. A walking surface that has a running slope steeper than one unit vertical in 20 units horizontal (5-percent slope).

SCISSOR STAIR. Two interlocking stairways providing two separate paths of egress located within one stairwell enclosure.

SMOKE-PROTECTED ASSEMBLY SEATING. Seating served by means of egress that is not subject to smoke accumulation within or under a structure.

STAIR. A change in elevation, consisting of one or more risers.

STAIRWAY. One or more flights of stairs, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.

STAIRWAY, EXTERIOR. A stairway that is open on at least one side, except for required structural columns, beams, handrails and guards. The adjoining open areas shall be either yards, courts or public ways. The other sides of the exterior stairway need not be open.

STAIRWAY, INTERIOR. A stairway not meeting the definition of an exterior stairway.

STAIRWAY, SPIRAL. A stairway having a closed circular form in its plan view with uniform section-shaped treads attached to and radiating from a minimum-diameter supporting column.

WINDER. A tread with nonparallel edges.

SECTION 1003
GENERAL MEANS OF EGRESS

1003.1 Applicability. The general requirements specified in Sections 1003 through 1013 shall apply to all three elements of the means of egress system, in addition to those specific requirements for the exit access, the exit and the exit discharge detailed elsewhere in this chapter.

1003.2 Ceiling height. The means of egress shall have a ceiling height of not less than 7 feet 6 inches (2286 mm).

Exceptions:

1. Sloped ceilings in accordance with Section 1208.2.
2. Ceilings of dwelling units and sleeping units within residential occupancies in accordance with Section 1208.2.

3. Allowable projections in accordance with Section 1003.3.
4. Stair headroom in accordance with Section 1009.2.
5. Door height in accordance with Section 1008.1.1.

1003.3 Protruding objects. Protruding objects shall comply with the requirements of Sections 1003.3.1 through 1003.3.4.

1003.3.1 Headroom. Protruding objects are permitted to extend below the minimum ceiling height required by Section 1003.2 provided a minimum headroom of 80 inches (2032 mm) shall be provided for any walking surface, including walks, corridors, aisles and passageways. Not more than 50 percent of the ceiling area of a means of egress shall be reduced in height by protruding objects.

Exception: Door closers and stops shall not reduce headroom to less than 78 inches (1981 mm).

A barrier shall be provided where the vertical clearance is less than 80 inches (2032 mm) high. The leading edge of such a barrier shall be located 27 inches (686 mm) maximum above the floor.

1003.3.2 Free-standing objects. A free-standing object mounted on a post or pylon shall not overhang that post or pylon more than 4 inches (102 mm) where the lowest point of the leading edge is more than 27 inches (686 mm) and less than 80 inches (2032 mm) above the walking surface. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (685 mm) maximum or 80 inches (2030 mm) minimum above the finished floor or ground.

Exception: This requirement shall not apply to sloping portions of handrails serving stairs and ramps.

1003.3.3 Horizontal projections. Elements cannot project over a walking surface more than 4 inches (102 mm) when they are located between 27 and 80 inches (686 and 2032 mm) above the floor. Handrails can project up to $4^1/_2$ inches (114 mm) from the wall.

1003.3.4 Clear width. For accessibility provisions related to protruding objects, refer to Section 11-4.4 as provided in Section 1003.3.

1003.4 Floor surface. Walking surfaces shall be slip resistant under foreseeable conditions. The walking surface of each element in the means of egress shall be uniformly slip resistant along the natural path of travel.

1003.5 Elevation change. Change in level in the means of egress shall be either by a ramp or a stair. The presence and location of ramped walkways shall be readily apparent.

1003.5.1 Where a change in level means of egress not exceeding 21 inches (533 mm) is achieved by a stair, the minimum tread depth of such stair shall be 13 inches (330 mm) and the presence and location of each step shall be readily apparent.

Exception: *Within dwelling level.*

1003.5.2 Where change in elevation of 12 inches (305 mm) or less occurs in exit access corridors, exits and exit discharge, ramps complying with Section 1010 shall be provided.

Exception: Within dwelling level.

1003.5.3 Accessibility. For accessibility provisions related to changes in levels, see Section 11-4.3.8.

1003.6 Means of egress continuity. The path of egress travel along a means of egress shall not be interrupted by any building element other than a means of egress component as specified in this chapter. Obstructions shall not be placed in the required width of a means of egress except projections permitted by this chapter. The required capacity of a means of egress system shall not be diminished along the path of egress travel.

1003.7 Elevators, escalators and moving walks. Elevators, escalators and moving walks shall not be used as a component of a required means of egress from any other part of the building.

Exception: Elevators used as an accessible means of egress in accordance with Section 1007.4.

SECTION 1004
OCCUPANT LOAD

1004.1 Design occupant load. In determining means of egress requirements, the number of occupants for whom means of egress facilities shall be provided shall be determined in accordance with this section. Where occupants from accessory areas egress through a primary space, the calculated occupant load for the primary space shall include the total occupant load of the primary space plus the number of occupants egressing through it from the accessory area.

Exceptions:

1. In a special purpose factory-industrial occupancy, the occupant load shall be the maximum number of persons to occupy the area under any probable conditions.
2. The occupant load for towers shall be the number of persons expected to occupy the space, with spaces not subject to human occupancy because of machinery or equipment excluded from the gross area calculation.

1004.1.1 Areas without fixed seating. The number of occupants shall be computed at the rate of one occupant per unit of area as prescribed in Table 1004.1.1. For areas without fixed seating, the occupant load shall not be less than that number determined by dividing the floor area under consideration by the occupant per unit of area factor assigned to the occupancy as set forth in Table 1004.1.1. Where an intended use is not listed in Table 1004.1.1, the building official shall establish a use based on a listed use that most nearly resembles the intended use.

Exception: Where approved by the building official, the actual number of occupants for whom each occupied space, floor or building is designed, although less than those determined by calculation, shall be permitted to be used in the determination of the design occupant load.

1004.2 Increased occupant load. The occupant load permitted in any building, or portion thereof, is permitted to be increased from that number established for the occupancies in Table 1004.1.1,

provided that all other requirements of the code are also met based on such modified number and the occupant load does not exceed one occupant per 7 square feet (0.65 m^2) of occupiable floor space. Where required by the building official, an approved aisle, seating or fixed equipment diagram substantiating any increase in occupant load shall be submitted. Where required by the building official, such diagram shall be posted.

1004.3 Posting of occupant load. Every room or space that is an assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or authorized agent.

1004.4 Exiting from multiple levels. Where exits serve more than one floor, only the occupant load of each floor considered individually shall be used in computing the required capacity of the exits at that floor, provided that the exit capacity shall not decrease in the direction of egress travel.

1004.5 Egress convergence. Where means of egress from floors above and below converge at an intermediate level, the capacity of the means of egress from the point of convergence shall not be less than the sum of the two floors.

TABLE 1004.1.1
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

FUNCTION OF SPACE	FLOOR AREA IN SQ FT PER OCCUPANT
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal Baggage claim Baggage handling Concourse Waiting areas	 20 gross 300 gross 100 gross 15 gross
Assembly Gaming floors (keno, slots, etc.)	 11 gross
Assembly with fixed seats	See Section 1004.7
Assembly without fixed seats Concentrated (chairs only—not fixed) Standing space Unconcentrated (tables and chairs)	 7 net 5 net 15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas	100 gross
Courtrooms—other than fixed seating areas	40 net
Day care	20 net
Dormitories	50 gross
Educational Classroom area Shops and other vocational room areas	 20 net 50 net

(*continued*)

TABLE 1004.1.1—continued
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

Exercise rooms	50 gross
Exercise rooms with equipment	50 gross
Exercise rooms without equipment	15 gross
H-5 Fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas Inpatient treatment areas Outpatient areas Sleeping areas	 240 gross 100 gross 120 gross
Kitchens, commercial	200 gross
Library Reading rooms Stack area	 50 net 100 gross
Locker rooms	50 gross
Mercantile Areas on other floors Basement and grade floor areas	 60 gross 30 gross
Multiple street floors - each (Note 1)	40 gross
Storage, stock, shipping areas	300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools Rink and pool	 50 gross
Swimming pool deck	30 gross
Swimming pool water surface	50 gross
Decks	15 gross
Stages and platforms	15 net
Warehouses	500 gross

For SI: 1 square foot = 0.0929 m^2.

1. For the purpose of determining occupant load in mercantile occupancies where, due to differences in grade of streets on different sides, two or more floors directly accessible from streets exist, each such floor shall be considered a street floor. The occupant load factor shall be one person for each 40 square feet (3.7 m^2) of gross floor area of sales space.
2. For any food court or other assembly use areas located in the mall that are not included as a portion of the gross leasable area of the mall buildings, the occupant load is calculated based on the occupant load factor for that use as specified in Table 1004.1.1. The remaining mall area is not required to be assigned an occupant load.

1004.6 Mezzanine levels. The occupant load of a mezzanine level with egress onto a room or area below shall be added to that room or area's occupant load, and the capacity of the exits shall be designed for the total occupant load thus established.

1004.7 Fixed seating. For areas having fixed seats and aisles, the occupant load shall be determined by the number of fixed seats installed therein. The occupant load for areas in which fixed seating is not installed, such as waiting spaces and wheelchair spaces, shall be determined in accordance with Section 1004.1.1 and added to the number of fixed seats.

For areas having fixed seating without dividing arms, the occupant load shall not be less than the number of seats based on one person for each 18 inches (457 mm) of seating length.

The occupant load of seating booths shall be based on one person for each 24 inches (610 mm) of booth seat length measured at the backrest of the seating booth.

1004.8 Outdoor areas. Yards, patios, courts and similar outdoor areas accessible to and usable by the building occupants shall be provided with means of egress as required by this chapter. The occupant load of such outdoor areas shall be assigned by the building official in accordance with the anticipated use. Where outdoor areas are to be used by persons in addition to the occupants of the building, and the path of egress travel from the outdoor areas passes through the building, means of egress requirements for the building shall be based on the sum of the occupant loads of the building plus the outdoor areas.

Exceptions:

1. Outdoor areas used exclusively for service of the building need only have one means of egress.
2. Both outdoor areas associated with Group R-3 and individual dwelling units of Group R-2.

1004.9 Multiple occupancies. Where a building contains two or more occupancies, the means of egress requirements shall apply to each portion of the building based on the occupancy of that space. Where two or more occupancies utilize portions of the same means of egress system, those egress components shall meet the more stringent requirements of all occupancies that are served.

SECTION 1005
EGRESS WIDTH

1005.1 Minimum required egress width. The means of egress width shall not be less than required by this section. The total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by the factors in Table 1005.1 and not less than specified elsewhere in this code. Multiple means of egress shall be sized such that the loss of any one means of egress shall not reduce the available capacity to less than 50 percent of the required capacity. The maximum capacity required from any story of a building shall be maintained to the termination of the means of egress.

Exception: Means of egress complying with Section 1025.

TABLE 1005.1
EGRESS WIDTH PER OCCUPANT SERVED

OCCUPANCY	WITHOUT SPRINKLER SYSTEM		WITH SPRINKLER SYSTEM[a]	
	Stairways (inches per occupant)	Other egress components (inches per occupant)	Stairways (inches per occupant)	Other egress components (inches per occupant)
Occupancies other than those listed below	0.3	0.2	0.3	0.2
Hazardous: H-1, H-2, H-3 and H-4	0.7	0.4	0.7	0.4
Health care	0.6	0.5	0.3	0.2
Institutional: I-2	NA	NA	0.4	0.2

For SI: 1 inch = 25.4 mm. NA = Not applicable.

a. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.

1005.2 Door encroachment. Doors opening into the path of egress travel shall not reduce the required width to less than one-half during the course of the swing. When fully open, the door shall not project more than 7 inches (178 mm) into the required width.

Exception: The restrictions on a door swing shall not apply to doors within individual dwelling units and sleeping units of Group R-2 and dwelling units of Group R-3.

SECTION 1006
MEANS OF EGRESS ILLUMINATION

1006.1 Means of egress illumination.

1006.1.1 Illumination of means of egress shall be provided in accordance with this section for every building and structure. For the purposes of this requirement, exit access shall include only designated stairs, aisles, corridors, ramps, escalators and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, aisles, corridors, ramps, escalators, walkways and exit passageways leading to a public way.

Exceptions:

1. When approved by the building official, illumination of means of egress shall not be required in industrial and storage occupancies that are occupied only during daylight hours, with skylights or windows arranged to provide the required level of illumination on all portions of the means of egress during these hours.
2. Assembly occupancy private party tents of 1,200 square feet (111 m^2) or less shall not be required to provide illumination of means of egress.
3. Open structures shall not be required to provide illumination of means of egress.
4. Towers occupied by not more than three persons shall not be required to provide illumination of means of egress.

1006.1.2 Illumination of means of egress shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use. Artificial lighting shall be employed at such places and for such periods of time as required to maintain the illumination to the minimum criteria values herein specified.

Exceptions: Automatic motion sensor-type lighting switches shall be permitted within the means of egress, provided that switch controllers are equipped for fail-safe operation, illumination timers are set for a minimum 15-minute duration and the motion sensor is activated by any occupant movement in the area served by the lighting units.

1006.1.3 The floors and other walking surfaces within an exit and within the portions of the exit access and exit discharge designated in Section 1006.1.1 shall be illuminated to values of at least 1 footcandle (10 lux) measured at the

floor. During conditions of stair use, the minimum illumination for new stairs shall be at least 108 lux (10 foot-candle), measured at the walking surface.

Exception: In assembly occupancies, the illumination of the floors of exit access shall be at least 0.2 footcandle (2 lux) during periods of performances or projections involving directed light.

1006.1.4 Required illumination shall be arranged so that the failure of any single lighting unit will not result in an illumination level in any designated area of less than 0.2 footcandle (2 lux).

1006.1.5 The equipment or units installed to meet the requirements of Section 1006.3 shall be permitted also to serve the function of illumination of means of egress, provided that all requirements of Section 1006.1 for such illumination are met.

1006.1.6 Sources of illumination.

1006.1.6.1 Illumination of means of egress shall be from a source of reasonably ensured reliability.

1006.1.6.2 Battery-operated electric lights and other types of portable lamps or lanterns shall not be used for primary illumination of means of egress. Battery-operated electric lights shall be permitted to be used as an emergency source to the extent permitted under Section 1006.2.3.4.

1006.2 Emergency lighting and standby power.

1006.2.1 Emergency lighting facilities for means of egress shall be provided in accordance with this section for the following:

1. Every building or structure where required in Table 1006.
2. Windowless and underground structures.

   Exception: One- and two-family dwellings.
3. High-rise structures.
4. At doors equipped with delayed egress locks.
5. The stair shaft and vestibule of smokeproof enclosures. A standby generator that is installed for the smokeproof enclosure mechanical ventilation equipment shall be permitted to be used for such stair shaft and vestibule power supply.

   For the purposes of this requirement, exit access shall include only designated stairs, aisles, corridors, ramps, escalators and passageways leading to an exit. For the purposes of this requirement, exit discharge shall include only designated stairs, ramps, aisles, walkways and escalators leading to a public way.

TABLE 1006
EMERGENCY LIGHTING REQUIREMENTS

OCCUPANCY	CONDITIONS	EXCEPTIONS
Assembly		Private party tents < 1200 sq ft
Educational	For interior stairs and corridors, normally occupied spaces, flexible and open-plan area, interior or windowless portions, shops and labs	Exempted from administrative areas, general classrooms, mechanical rooms and storage rooms
Group I-1 and I-2	If using life-support systems, supply the required power from life safety branch of electricals as required by NFPA 99	None
Outpatient clinics, ambulatory	If using life-support systems for other than emergency purposes, supply the required power essentials electrical system as required by NFPA 99	None
Group I-3	None	None
Hotels and dormitories	> 25 rooms	All rooms direct to grade
Apartment buildings	>12 units or >3 stories	All apartments direct to grade
Group R-4, large facilities	>25 rooms	All rooms direct to grade
Mercantile	>1 story > 3000 sq ft gross sales area and malls	None
Business	>2 stories above LED, or ≥ 50 people above or below LED, or ≥ 300 people total	None
Industrial	None	When approved by the building official, special purpose without routine occupancy or daylight operations with windows
Storage	None	When approved by the building official, not normally occupied or daylight operations with windows
Day care centers	For interior stairs and corridors, normally occupied spaces, flexible and open-plan area, interior or windowless portions, shops and labs	Exempted from administrative areas, general classrooms, mechanical rooms and storage rooms

For SI: 1 square foot = 0.0929 m^2.

Exceptions:

1. Towers occupied by three or fewer persons shall be exempt from emergency lighting requirements.
2. Locations in towers not routinely inhabited by humans shall be exempt from emergency lighting requirements.
3. When approved by the building official, illumination of means of egress shall not be required in towers that are occupied only during daylight hours, with windows arranged to provide the required level of illumination on all portions of the means of egress during these hours.
4. Water-surrounded structures in locations not routinely inhabited by humans shall be exempt from emergency lighting requirements.
5. When approved by the building official, illumination of means of egress shall not be required in water-surrounded structures that are occupied only during daylight hours, with windows arranged to provide the required level of illumination on all portions of the means of egress during these hours.

1006.2.2 Where maintenance of illumination depends upon changing from one energy source to another, a delay of not more than 10 seconds shall be permitted.

1006.2.3 Performance of system.

1006.2.3.1 Emergency illumination shall be provided for a period of hours $1^1/_2$ in the event of failure of normal lighting. Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of 1 footcandle (10 lux) and a minimum at any point of 0.1 footcandle (1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 footcandle (6 lux) average and a minimum at any point of 0.06 footcandle (0.6 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40:1 shall not be exceeded.

1006.2.3.2 The emergency lighting system shall be arranged to provide the required illumination automatically in the event of any interruption of normal lighting, such as any failure of public utility or other outside electrical power supply; opening of a circuit breaker or fuse or any manual act(s), including accidental opening of a switch controlling normal lighting facilities.

1006.2.3.3 Emergency generators providing power to emergency lighting systems shall be installed in accordance with NFPA 110. Stored electrical energy systems where required in this code shall be installed and tested in accordance with NFPA 111.

1006.2.3.4 Battery-operated emergency lights shall use only reliable types of rechargeable batteries provided with suitable facilities for maintaining them in a properly charged condition. Batteries used in such lights or units shall be approved for their intended use and shall comply with Chapter 27 of the *Florida Building Code, Building*.

1006.2.3.5 The emergency lighting system shall be either continuously in operation or shall be capable of repeated automatic operation without manual intervention.

1006.2.4 Standby power. High-rise buildings shall be provided with Class 1, Type 60 standby power in accordance with Chapter 27 of the *Florida Building Code, Building* and NFPA 110. The standby power system shall have a capacity and rating sufficient to supply all required equipment. Selective load pickup and load shedding shall be permitted in accordance with Chapter 27 of the *Florida Building Code, Building*. The standby power system shall be connected to the following:

1. Emergency lighting system.
2. At least one elevator serving all floors and transferable to any elevator.
3. Mechanical equipment for smokeproof enclosures.

(See Section 403 for additional requirements for standby power in high-rise structures.)

1006.3 Exit signs.

1006.3.1 Exits shall be marked by an approved sign readily visible from any direction of exit access. Every exit sign shall be suitably illuminated by a reliable light source. Externally and internally illuminated signs shall be visible in both normal and emergency lighting.

Exception: Main exterior exit doors that obviously and clearly are identifiable as exits.

1006.3.2 New sign placement shall be such that no point in an exit access corridor is in excess of the rated viewing distance or 100 feet (30 m) whichever is less, from the nearest sign.

1006.3.3 Every required sign shall be located and of such size, distinctive color and design as to be readily visible and shall provide contrast with interior finish or other signs. No equipment that impairs visibility of an exit sign shall be permitted, nor shall there be any brightly illuminated sign or object in or near the line of vision of the required exit sign of such a character as to detract attention from the exit sign. Floor proximity signs, where required, shall be in accordance with Section 1006.3.8.2 or 1006.3.8.3.

1006.3.4 Exit stair door or tactile signage. Tactile signage stating "EXIT" and complying with ICC/ANSI A117.1, shall be installed adjacent to the latch side of the door 60 inches (1524 mm) above the finished floor to the center line of the sign.

1006.3.5 Externally illuminated signs shall have the word "EXIT" or other appropriate wording in plainly legible letters not less than 6 inches (15 2 mm) high with the principal strokes of letters not less than $^3/_4$ inches (19 mm) wide. The word "EXIT" shall have letters of a width not less than 2 inches (51 mm), except the letter "I," and the minimum spacing between letters shall be not less than $^3/_8$ inches (10

mm). Signs larger than the minimum established in this paragraph shall have letter widths, strokes and spacing in proportion to their height. Externally illuminated signs shall be illuminated by not less than 5 footcandles (50 lux) at the illuminated surface and shall have a contrast ratio of not less than 0.5.

Exceptions:

1. Marking required by Section 1009.5.3.
2. Group R-3 and Group R-4 (small facility) occupancies.

1006.3.6 Internally illuminated signs shall be listed in accordance with UL 924, *Standard for Safety Emergency Lighting Power Equipment*. The visibility of an internally illuminated sign shall be the equivalent of an externally illuminated sign that complies with Section 1006.3.5.

Exceptions:

1. Marking required by Section 1009.5.3.
2. Signs in compliance with Sections 1006.3.4 and 1006.3.8.2.

1006.3.7 Where emergency lighting facilities are required by Section 1006.2, the exit signs shall be illuminated by the emergency lighting facilities. The level of illumination of the exit sign shall be at the levels provided in accordance with Section 1006.3.5 for the required emergency lighting time duration as specified in Section 1006.2.3.1, but shall be permitted to decline to 60 percent of the illumination level at the end of the emergency lighting time duration.

1006.3.8 Where the direction of travel to reach the nearest exit is not apparent, a directional sign complying with Sections 1006.3.5 or 1006.3.6 reading "EXIT," or a similar designation with a directional indicator showing the direction of travel shall be placed in every location. Directional signs shall be listed.

1006.3.8.1 The directional indicator shall be located outside of the "EXIT" legend, not less than $^3/_8$ inches (10 mm) from any letter. The directional indicator shall be of a chevron type and shall be identifiable as a directional indicator at a minimum distance of 40 feet (12.2 m). A directional indicator larger than the minimum established in this section shall be proportionately increased in height, width and stroke. The directional indicators shall be located at the end of the sign for the direction indicated.

1006.3.8.2 Where floor proximity exit signs are required, exit signs shall be placed near the floor level in addition to those signs required for doors or corridors. These signs shall be illuminated in accordance with Section 1006.3. Externally illuminated signs shall be sized in accordance with Section 1006.3.5. The bottom of the sign shall be at least 6 inches (152 mm) and no more than 8 inches (203 mm) above the floor. For exit doors, the sign shall be mounted on the door or adjacent to the door with the nearest edge of the sign within 4 inches (102 mm) of the door frame.

1006.3.8.3 Where floor proximity egress path marking is required, a listed and approved floor proximity egress path marking system that is internally illuminated shall be installed within 18 inches (457 mm) of the floor. The system shall provide a visible delineation of the path of travel along the designated exit access and shall be essentially continuous, except as interrupted by doorways, hallways, corridors or other such architectural features. The system shall operate continuously or at any time the building fire alarm system is activated. The activation, duration and continuity of operation of the system shall be in accordance with Section 1006.2.

1006.3.9 Signs installed as projections from a wall or ceiling within the means of egress shall provide vertical clearance no less than 80 inches (2134 mm) from the walking surface.

1006.4 Performance of system. Reserved.

SECTION 1007
ACCESSIBLE MEANS OF EGRESS

1007.1 Accessible means of egress. Accessible means of egress shall be provided in accordance with Sections 11-4.1.3(8), 11-4.1.3(9) and 11-4.3(10).

1007.2 Continuity and components. Reserved.

1007.3 Exit stairways. Reserved.

1007.4 Elevators. Reserved.

1007.5 Platform lifts. Reserved.

1007.6 Areas of refuge. Reserved.

1007.7 Signage. Reserved.

1007.8 Exterior area for assisted rescue. Reserved.

SECTION 1008
DOORS, GATES AND TURNSTILES

1008.1 Doors. Means of egress doors shall meet the requirements of this section. Doors serving a means of egress system shall meet the requirements of this section and Section 1017.2. Doors provided for egress purposes in numbers greater than required by this code shall meet the requirements of this section. For accessibility provisions related to doors, refer to Sections 11-4.1.3, 11-4.3.9 and 11-4.13.

Means of egress doors shall be readily distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Mirrors or similar reflecting materials shall not be used on means of egress doors. Means of egress doors shall not be concealed by curtains, drapes, decorations or similar materials.

1008.1.1 Size of doors. The minimum width of each door opening shall be sufficient for the occupant load thereof and shall provide a clear width of not less than 32 inches (813 mm). Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). Where this section requires a minimum clear width of 32 inches (813 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a clear opening width of 32 inches (813 mm). The maximum width of a swinging door leaf

shall be 48 inches (1219 mm) nominal. Means of egress doors in a Group I-2 occupancy used for the movement of beds shall provide a clear width not less than 41.5 inches (1054 mm). The height of doors shall not be less than 80 inches (2032 mm).

Exceptions:

1. The minimum and maximum width shall not apply to door openings that are not part of the required means of egress in Group R-2 and R-3 occupancies.
2. Door openings to resident sleeping units in Group I-3 occupancies shall have a clear width of not less than 28 inches (711 mm).
3. Door openings to storage closets less than 10 square feet (0.93 m^2) in area shall not be limited by the minimum width.
4. Width of door leafs in revolving doors that comply with Section 1008.1.3.1 shall not be limited.
5. Door openings within a dwelling unit or sleeping unit shall not be less than 78 inches (1981 mm) in height.
6. Exterior door openings in dwelling units and sleeping units, other than the required exit door, shall not be less than 76 inches (1930 mm) in height.
7. In other than Group R-1 occupancies, the minimum widths shall not apply to interior egress doors within a dwelling unit or sleeping unit that is not required to be an Accessible unit, Type A unit or Type B unit.
8. Door openings required to be accessible within Type B units shall have a minimum clear width of 31.75 inches (806 mm).

1008.1.1.1 Projections into clear width. There shall not be projections into the required clear width lower than 34 inches (864 mm) above the floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the floor or ground shall not exceed 4 inches (102 mm).

1008.1.2 Door swing. Egress doors shall be side-hinged swinging.

Exceptions:

1. Private garages, office areas, factory and storage areas with an occupant load of 10 or less.
2. Group I-3 occupancies used as a place of detention.
3. Critical or intensive care patient rooms within suites of health care facilities.
4. Doors within or serving a single dwelling unit in Groups R-2 and R-3.
5. In other than Group H occupancies, revolving doors complying with Section 1008.1.3.1.
6. In other than Group H occupancies, horizontal sliding doors complying with Section 1008.1.3.3 are permitted in a means of egress.
7. Power-operated doors in accordance with Section 1008.1.3.2.
8. Doors serving a bathroom within an individual sleeping unit in Group R-1.

Doors shall swing in the direction of egress travel where serving an occupant load of 50 or more persons or a Group H occupancy.

The opening force for interior side-swinging doors without closers shall not exceed a 5-pound (22 N) force. For other side-swinging, sliding and folding doors, the door latch shall release when subjected to a 15-pound (67 N) force. The door shall be set in motion when subjected to a 30-pound (133 N) force. The door shall swing to a full-open position when subjected to a 15-pound (67 N) force. Forces shall be applied to the latch side.

1008.1.3 Special doors. Special doors and security grilles shall comply with the requirements of Sections 1008.1.3.1 through 1008.1.3.5.

1008.1.3.1 Revolving doors. Revolving doors shall comply with the following:

1. Each revolving door shall be capable of collapsing into a bookfold position with parallel egress paths providing an aggregate width of 36 inches (914 mm).
2. A revolving door shall not be located within 10 feet (3048 mm) of the foot of or top of stairs or escalators. A dispersal area shall be provided between the stairs or escalators and the revolving doors.
3. The revolutions per minute (rpm) for a revolving door shall not exceed those shown in Table 1008.1.3.1.
4. Each revolving door shall have a side-hinged swinging door which complies with Section 1008.1 in the same wall and within 10 feet (3048 mm) of the revolving door, unless one of the following conditions applies:
   a. Revolving doors shall be permitted without adjacent swinging doors, as required by Section 1008.1.3.1(4) in street floor elevator lobbies, provided that no stairways or doors from other parts of the building discharge through the lobby and the lobby has no occupancy other than as means of travel between the elevators and the street.
   b. The requirement of Section 1008.1.3.1(4) shall not apply to existing revolving doors where the number of revolving doors does not exceed the number of swinging doors within 240 inches (6100 mm) of the revolving doors.

TABLE 1008.1.3.1
REVOLVING DOOR SPEEDS

INSIDE DIAMETER (feet-inches)	POWER-DRIVEN-TYPE SPEED CONTROL (rpm)	MANUAL-TYPE SPEED CONTROL (rpm)
6-6	11	12
7-0	10	11
7-6	9	11
8-0	9	10
8-6	8	9
9-0	8	9
9-6	7	8
10-0	7	8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

1008.1.3.1.1 Egress component. A revolving door used as a component of a means of egress shall comply with Section 1008.1.3.1 and the following three conditions:

1. Revolving doors shall not be given credit for more than 50 percent of the required egress capacity.
2. Each revolving door shall be credited with no more than a 50-person capacity.
3. Each revolving door shall be capable of being collapsed when a force of not more than 130 pounds (578 N) is applied within 3 inches (76 mm) of the outer edge of a wing.

1008.1.3.1.2 Other than egress component. A revolving door used as other than a component of a means of egress shall comply with Section 1008.1.3.1. The collapsing force of a revolving door not used as a component of a means of egress shall not be more than 180 pounds (801 N).

Exception: A collapsing force in excess of 180 pounds (801 N) is permitted if the collapsing force is reduced to not more than 130 pounds (578 N) when at least one of the following conditions is satisfied:

1. There is a power failure or power is removed to the device holding the door wings in position.
2. There is an actuation of the automatic sprinkler system where such system is provided.
3. There is an actuation of a smoke detection system which is installed in accordance with Section 907 to provide coverage in areas within the building which are within 75 feet (22 860 mm) of the revolving doors.
4. There is an actuation of a manual control switch, in an approved location and clearly defined, which reduces the holding force to below the 130-pound (578 N) force level.

1008.1.3.2 Power-operated doors. Where means of egress doors are operated by power, such as doors with a photoelectric-actuated mechanism to open the door upon the approach of a person, or doors with power-assisted manual operation, the design shall be such that in the event of power failure, the door is capable of being opened manually to permit means of egress travel or closed where necessary to safeguard means of egress. The forces required to open these doors manually shall not exceed those specified in Section 1008.1.2, except that the force to set the door in motion shall not exceed 50 pounds (220 N). The door shall be capable of swinging from any position to the full width of the opening in which such door is installed when a force is applied to the door on the side from which egress is made. Full-power-operated doors shall comply with BHMA A156.10. Power-assisted and low-energy doors shall comply with BHMA A156.19. On the egress side of each door, there shall be a readily visible, durable sign that reads: "IN EMERGENCY PUSH TO OPEN."

The sign shall be in letters not less than 1 inch (25 mm) high on a contrasting background.

Exceptions:

1. Occupancies in Group I-3.
2. Horizontal sliding doors complying with Section 1008.1.3.3.
3. Sliding, power-operated doors in exit access serving an occupant load of fewer than 50 that manually opens in the direction of door travel with forces not more than required in Section 1008 shall not be required to have a swing-out feature. The required sign shall state, "IN EMERGENCY, SLIDE TO OPEN."
4. In the emergency breakout mode, a door leaf located within a two-leaf opening shall be exempt from the minimum 32-inch (813 mm) single-leaf requirement, provided the clear width of the single leaf is at least 30 inches (762 mm).
5. For a biparting door in the emergency breakout mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 32-inch (813 mm) single-leaf requirement of Section 1008.1.1, provided a minimum 32-inch (813 mm) clear opening is provided when the two biparting leaves meeting in the center are broken out.

1008.1.3.3 Horizontal sliding doors. In other than Group H occupancies, horizontal sliding doors permitted to be a component of a means of egress in accordance with Exception 6 to Section 1008.1.2 shall comply with all of the following criteria:

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.
2. The doors shall be openable by a simple method from both sides without special knowledge or effort.

3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.
5. The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic-closing by smoke detection, shall be installed in accordance with NFPA 80 and shall comply with Section 715.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.
9. In apartment buildings, hotels and dormitories, horizontal sliding doors shall not be used across corridors.

1008.1.3.4 Access-controlled egress doors. The entrance doors in a means of egress in buildings with an occupancy in Group A, B, D, E, M, R-1 or R-2 and entrance doors to tenant spaces in occupancies in Groups A, B, D, E, M, R-1 and R-2 are permitted to be equipped with an approved entrance and egress access control system which shall be installed in accordance with all of the following criteria:

1. A sensor shall be provided on the egress side arranged to detect an occupant approaching the doors. The doors shall be arranged to unlock by a signal from or loss of power to the sensor.
2. Loss of power to that part of the access control system which locks the doors shall automatically unlock the doors.
3. The doors shall be arranged to unlock from a manual unlocking device located 40 inches to 48 inches (1016 mm to 1219 mm) vertically above the floor and within 5 feet (1524 mm) of the secured doors. Ready access shall be provided to the manual unlocking device and the device shall be clearly identified by a sign that reads "PUSH TO EXIT." When operated, the manual unlocking device shall result in direct interruption of power to the lock—independent of the access control system electronics—and the doors shall remain unlocked for a minimum of 30 seconds.
4. Activation of the building fire alarm system, if provided, shall automatically unlock the doors, and the doors shall remain unlocked until the fire alarm system has been reset.
5. Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically unlock the doors. The doors shall remain unlocked until the fire alarm system has been reset.
6. Entrance doors in buildings with an occupancy in Group A, B, E or M shall not be secured from the egress side during periods that the building is open to the general public.

1008.1.3.5 Security grilles. In Groups B, F, M, R and S, horizontal sliding or vertical security grilles are permitted at the main exit and shall be openable from the inside without the use of a key or special knowledge or effort during periods that the space is occupied. The grilles shall remain secured in the full-open position during the period of occupancy by the general public. Where two or more means of egress are required, not more than one-half of the exits or exit access doorways shall be equipped with horizontal sliding or vertical security grilles.

1008.1.3.6 The temporary installation or closure of storm shutters, panels and other approved hurricane protection devices shall be permitted on emergency escape and rescue openings in Group R occupancies during the threat of a storm. Such devices shall not be required to comply with the operational constraints of Section 1026.4. While such protection is provided, at least one means of escape from the dwelling or dwelling unit shall be provided. The means of escape shall be within the first floor of the dwelling or dwelling unit and shall not be located within a garage without a side hinged door leading directly to the exterior. Occupants in any part of the dwelling or dwelling unit shall be able to access the means of escape without passing through a lockable door not under their control.

1008.1.3.7 Self-closing doors. Where doors are required to be self-closing and are operated by power upon the approach of a person or are provided with power-assisted manual operation, they shall be permitted in the means of egress in accordance with the following:

1. Doors can be opened manually in accordance with Section 1008.1.3.2 to allow egress travel in the event of power failure.
2. The doors remain in the closed position unless actuated or opened manually.
3. When actuated, doors remain open for not more than 30 seconds.
4. Doors held open for any period of time close and the power-assist mechanism ceases to function upon operation of approved smoke detectors installed in such a way as to detect smoke on either side of the door opening in accordance with the provisions of NFPA 72.
5. Doors required to be self-latching are either self-latching or become self-latching upon operation of approved smoke detectors in accordance with Section 1008.1.3.7(4).
6. Power-assisted swinging doors shall comply with ANSI/BHMA A156.19.

1008.1.4 Floor elevation. There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed one unit vertical in 50 units horizontal (2-percent slope).

Exceptions:

1. Doors serving individual dwelling units in Groups R-2 and R-3 where the following apply:
   1.1. A door is permitted to open at the top step of an interior flight of stairs, provided the door does not swing over the top step.
   1.2. Screen doors and storm doors are permitted to swing over stairs or landings.
2. Exterior doors as provided for in Section 1003.5, Exception 1, and Section 1018.2, which are not on an accessible route.
3. In Group R-3 occupancies not required to be Accessible units, Type A units or Type B units, the landing at an exterior doorway shall not be more than 7.75 inches (197 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door, does not swing over the landing.
4. Variations in elevation due to differences in finish materials, but not more than 0.5 inch (12.7 mm).
5. Exterior decks, patios or balconies that are part of Type B dwelling units, have impervious surfaces and that are not more than 4 inches (102 mm) below the finished floor level of the adjacent interior space of the dwelling unit.

1008.1.5 Landings at doors. Landings shall have a width not less than the width of the stairway or the door, whichever is greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches (178 mm). When a landing serves an occupant load of 50 or more, doors in any position shall not reduce the landing to less than one-half its required width. Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm).

Exception: Landing length in the direction of travel in Groups R-3 and U and within individual units of Group R-2 need not exceed 36 inches (914 mm).

1008.1.6 Thresholds. Thresholds at doorways shall not exceed 0.75 inch (19.1 mm) in height for sliding doors serving dwelling units or 0.5 inch (12.7 mm) for other doors. Raised thresholds and floor level changes greater than 0.25 inch (6.4 mm) at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (50-percent slope).

Exceptions:

1. The threshold height shall be limited to $7^3/_4$ inches (197 mm) where the occupancy is Group R-2, the door is an exterior door that is not a component of the required means of egress and the doorway is not on an accessible route. In one- and two-family dwellings where the door discharges to the outside or to an exterior balcony or exterior exit access, the floor level outside the door shall be permitted to be one step lower than the inside, but not more than 8 inches (203 mm) lower.
2. For exterior doors serving dwelling units, thresholds at doorways shall not exceed the height required to pass the water resistance test of ANSI/AAMA/WDMA 101/I.S.2, or TAS 202 for high-velocity hurricane zones, or the maximum allowable height difference between interior floor level. Exterior floor level shall comply with the following:

LEVEL DIFFERENCE (inches)	AT PRIMARY DOOR
0	Pervious construction (e.g., wood decking with spaces)
$^1/_2$	Impervious construction (e.g., concrete, brick or flag stone)
LEVEL DIFFERENCE (inches)	**AT SECONDARY DOOR**
$^1/_2$	Pervious construction
4	Impervious construction

For SI: 1 inch = 25.4 mm.

1008.1.7 Door arrangement. Space between two doors in a series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in a series shall swing either in the same direction or away from the space between the doors.

Exceptions:

1. The minimum distance between horizontal sliding power-operated doors in a series shall be 48 inches (1219 mm).
2. Storm and screen doors serving individual dwelling units in Groups R-2 and R-3 need not be spaced 48 inches (1219 mm) from the other door.
3. Doors within individual dwelling units in Groups R-2 and R-3 other than within Type A dwelling units.

1008.1.8 Door operations. Except as specifically permitted by this section egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort.

1008.1.8.1 Hardware. Door handles, pulls, latches, locks and other operating devices on doors required to be accessible by Chapter 11 shall not require tight grasping, tight pinching or twisting of the wrist to operate.

1008.1.8.2 Hardware height. A latch or other fastening device on a door shall be provided with a releasing device having an obvious method of operation under all lighting conditions. The releasing mechanism for any latch shall be located at least 34 inches (864 mm) and not more than 48 inches (1219 mm) above the finished floor.

Doors shall be openable with not more than one releasing operation.

Exception: Egress doors from individual living units and guest rooms of residential occupancies shall be permitted to be provided with devices that require not more than one additional releasing operation if such device is operable from the inside without the use of a key or tool and is mounted at a height not more than 48 inches (1219 mm) above the finished floor.

1008.1.8.3 Locks and latches. Locks and latches shall be permitted to prevent operation of doors where any of the following exists:

1. Places of detention or restraint.
2. In buildings in occupancy Group A having an occupant load of 300 or less, Groups B, F, M and S, and in places of religious worship, the main exterior door or doors are permitted to be equipped with key-operated locking devices from the egress side provided:
   2.1. The locking device is readily distinguishable as locked,
   2.2. A readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED. The sign shall be in letters 1 inch (25 mm) high on a contrasting background,
   2.3. The use of the key-operated locking device is revokable by the building official for due cause.
3. Where egress doors are used in pairs, approved automatic flush bolts shall be permitted to be used, provided that the door leaf having the automatic flush bolts has no doorknob or surface-mounted hardware.
4. Doors from individual dwelling or sleeping units of Group R occupancies having an occupant load of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.

1008.1.8.4 Bolt locks. Manually operated flush bolts or surface bolts are not permitted. All hardware must be direct acting requiring no more than one operation. Double cylinder dead bolts, requiring a key for operation on both sides, are prohibited on required means of egress doors unless the locking device is provided with a key which cannot be removed when the door is locked from the inside. Only one locking or latching device shall be permitted on a door or on one leaf of a pair of doors.

Exceptions:

1. On doors not required for egress in individual dwelling units or sleeping units.
2. Where a pair of doors serves a storage or equipment room, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf.

1008.1.8.5 Unlatching. The unlatching of any door or leaf shall not require more than one operation.

Exceptions:

1. Places of detention or restraint.
2. Where manually operated bolt locks are permitted by Section 1008.1.8.4.
3. Doors with automatic flush bolts as permitted by Section 1008.1.8.3, Exception 3.
4. Doors from individual dwelling units and sleeping units of Group R occupancies as permitted by Section 1008.1.8.3, Exception 4.

1008.1.8.6 Delayed egress locks. Approved, listed, delayed egress locks shall be permitted to be installed on doors serving any occupancy except Group A, E and H occupancies in buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or an approved automatic smoke or heat detection system installed in accordance with Section 907, provided that the doors unlock in accordance with Items 1 through 6 below. A building occupant shall not be required to pass through more than one door equipped with a delayed egress lock before entering an exit.

1. The doors unlock upon actuation of the automatic sprinkler system or automatic fire detection system.
2. The doors unlock upon loss of power controlling the lock or lock mechanism.
3. The door locks shall have the capability of being unlocked by a signal from the fire command center.
4. The initiation of an irreversible process which will release the latch in not more than 15 seconds when a force of not more than 15 pounds (67 N) is applied for 1 second to the release device. Initiation of the irreversible process shall activate an audible signal in the vicinity of the door. Once the door lock has been released by the application of force to the releasing device, relocking shall be by manual means only.

   Exception: Where approved, a delay of not more than 30 seconds is permitted.
5. A sign shall be provided on the door located above and within 12 inches (305 mm) of the release device reading: PUSH UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS.
6. Emergency lighting shall be provided at the door.

1008.1.8.7 Stairway doors. Interior stairway means of egress doors shall be openable from both sides without the use of a key or special knowledge or effort.

Exceptions:

1. Stairway discharge doors shall be openable from the egress side and shall only be locked from the opposite side.
2. This section shall not apply to doors arranged in accordance with Section 403.12.
3. In stairways serving not more than four stories, doors are permitted to be locked from the side opposite the egress side, provided they are openable from the egress side and capable of being unlocked simultaneously without unlatching upon a signal from the fire command center, if present, or a signal by emergency personnel from a single location inside the main entrance to the building.

1008.1.8.8 During its swing, any door in a means of egress shall leave unobstructed at least one half of the required width of an aisle, corridor, passageway or landing, nor project more than 7 inches (178 mm) into the required width of an aisle, corridor, passageway or landing, when fully open. Doors shall not open immediately onto a stair without a landing. The landing shall have a width at least equal to the width of the door. See Section 1027 for door swing in Group E occupancies.

Every door in a stair enclosure serving more than four stories shall permit reentry from the stair enclosure to the interior of the building, or an automatic release shall be provided to unlock all stair enclosure doors to permit reentry. Such automatic release shall be actuated with the initiation of the building fire alarm, fire detection or fire sprinkler system.

Exception: Doors on stair enclosures shall be permitted to be equipped with hardware that prevents reentry into the interior of the building, provided that the following conditions are met:

1. There are at least two levels where it is possible to leave the stair enclosure;
2. There are not more than four stories intervening between stories where it is possible to leave the stair enclosure;
3. Reentry is possible on the top or next to top story permitting access to another exit;
4. Doors permitting reentry are identified as such on the stair side of the door; and
5. Doors not permitting reentry are provided with a sign on the stair side indicating the location of the nearest door, in each direction of travel, permitting reentry or exit.

1008.1.9 Panic and fire exit hardware. Where panic and fire exit hardware is installed, it shall comply with the following:

1. The actuating portion of the releasing device shall extend at least one-half of the door leaf width.
2. The maximum unlatching force shall not exceed 15 pounds (67 N).

Each door in a means of egress from a Group A or E occupancy having an occupant load of 50 or more and any Group H occupancy shall not be provided with a latch or lock unless it is panic hardware or fire exit hardware.

Exception: A main exit of a Group A occupancy in compliance with Section 1008.1.8.3, Item 2.

Electrical rooms with equipment rated 1,200 amperes or more and over 6 feet (1829 mm) wide that contain overcurrent devices, switching devices or control devices with exit access doors must be equipped with panic hardware and doors must swing in the direction of egress.

If balanced doors are used and panic hardware is required, the panic hardware shall be the push-pad type and the pad shall not extend more then one-half the width of the door measured from the latch side.

1008.2 Gates. Gates serving the means of egress system shall comply with the requirements of this section. Gates used as a component in a means of egress shall conform to the applicable requirements for doors.

Exception: Horizontal sliding or swinging gates exceeding the 4-foot (1219 mm) maximum leaf width limitation are permitted in fences and walls surrounding a stadium.

1008.2.1 Stadiums. Panic hardware is not required on gates surrounding stadiums where such gates are under constant immediate supervision while the public is present, and where safe dispersal areas based on 3 square feet (0.28 m^2) per occupant are located between the fence and enclosed space. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from the enclosed space. See Section 1024.6 for means of egress from safe dispersal areas.

1008.3 Turnstiles. Turnstiles or similar devices that restrict travel to one direction shall not be placed so as to obstruct any required means of egress.

Exception: Each turnstile or similar device shall be credited with no more than a 50-person capacity where all of the following provisions are met:

1. Each device shall turn free in the direction of egress travel when primary power is lost, and upon the manual release by an employee in the area.
2. Such devices are not given credit for more than 50 percent of the required egress capacity.
3. Each device is not more than 39 inches (991 mm) high.
4. Each device has at least 16.5 inches (419 mm) clear width at and below a height of 39 inches (991 mm) and at least 22 inches (559 mm) clear width at heights above 39 inches (991 mm).

Where located as part of an accessible route, turnstiles shall have at least 36 inches (914 mm) clear at and below a height of 34 inches (864 mm), at least 32 inches (813 mm) clear width between 34 inches (864 mm) and 80 inches (2032 mm) and shall consist of a mechanism other than a revolving device.

1008.3.1 High turnstile. Turnstiles more than 39 inches (991 mm) high shall meet the requirements for revolving doors.

1008.3.2 Additional door. Where serving an occupant load greater than 300, each turnstile that is not portable shall have a side-hinged swinging door which conforms to Section 1008.1 within 50 feet (15 240 mm).

SECTION 1009
STAIRWAYS

1009.1 Stairway width. The width of stairways shall be determined as specified in Section 1005.1, but such width shall not be less than 44 inches (1118 mm). See Section 1007.1 for accessible means of egress stairways.

Exceptions:

1. Stairways serving an occupant load of less than 50 shall have a width of not less than 36 inches (914 mm).
2. Spiral stairways as provided for in Section 1009.8.
3. Aisle stairs complying with Section 1025.
4. Where an incline platform lift or stairway chairlift is installed on stairways serving occupancies in Group R-3, or within dwelling units in occupancies in Group R-2, a clear passage width not less than 20 inches (508 mm) shall be provided. If the seat and platform can be folded when not in use, the distance shall be measured from the folded position.

1009.2 Headroom. Stairways shall have a minimum headroom clearance of 80 inches (2032 mm) measured vertically from a line connecting the edge of the nosings. Such headroom shall be continuous above the stairway to the point where the line intersects the landing below, one tread depth beyond the bottom riser. The minimum clearance shall be maintained the full width of the stairway and landing.

Exception: Spiral stairways complying with Section 1009.8 are permitted a 78-inch (1981 mm) headroom clearance.

1009.3 Stair treads and risers. Stair riser heights shall be 7 inches (178 mm) maximum and 4 inches (102 mm) minimum. Stair tread depths shall be 11 inches (279 mm) minimum. The riser height shall be measured vertically between the leading edges of adjacent treads. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. Winder treads shall have a minimum tread depth of 11 inches (279 mm) measured at a right angle to the tread's leading edge at a point 12 inches (305 mm) from the side where the treads are narrower and a minimum tread depth of 10 inches (254 mm).

Exceptions:

1. Alternating tread devices in accordance with Section 1009.9.
2. Spiral stairways in accordance with Section 1009.8.
3. Aisle stairs in assembly seating areas where the stair pitch or slope is set, for sightline reasons, by the slope of the adjacent seating area in accordance with Section 1025.11.2.
4. In occupancies in Group R-3, as applicable in Section 101.2, within dwelling units in occupancies in Group R-2, as applicable in Section 101.2, and in occupancies in Group U, which are accessory to an occupancy in Group R-3, as applicable in Section 101.2, the maximum riser height shall be 7.75 inches (197 mm) and the minimum tread depth, exclusive of nosing, shall be not less than 9 inches (229 mm), the minimum winder tread depth at the walk line shall be 10 inches (254 mm), and the minimum winder tread depth shall be 6 inches (152 mm). Treads and risers of stairs shall be permitted to be so proportioned that the sum of two risers and a tread, exclusive of projection of nosing, is not less than 24 inches (610 mm) nor more than 25 inches (635 mm). Every tread less than 10 inches (254 mm) wide shall have a nosing, or effective projection, of approximately 1 inch (25 mm) over the level immediately below that tread.
5. See the *Florida Building Code, Existing Building* for the replacement of existing stairways.
6. Industrial equipment access stairs and landings that serve as a component of the means of egress from the involved equipment and do not serve more than 20 people shall be permitted to have a minimum clear width of 22 inches (559 mm), minimum tread depth of 10 inches (254 mm), maximum riser height of 9 inches (229 mm), minimum headroom of 6 feet 8 inches (2032 mm), and a maximum height between landings of 12 feet (36 576 mm).

1009.3.1 Winder treads. Winder treads are not permitted in means of egress stairways except within a dwelling unit.

Exceptions:

1. Curved stairways in accordance with Section 1009.7.
2. Spiral stairways in accordance with Section 1009.8.

1009.3.2 Dimensional uniformity. Stair treads and risers shall be of uniform size and shape. The tolerance between the largest and smallest riser height or between the largest and smallest tread depth shall not exceed 0.375 inch (9.5 mm) in any flight of stairs. The greatest winder tread depth at the 12-inch (305 mm) walk line within any flight of stairs shall not exceed the smallest by more than 0.375 inch (9.5 mm) measured at a right angle to the tread's leading edge.

Exceptions:

1. Nonuniform riser dimensions of aisle stairs complying with Section 1025.11.2.
2. Consistently shaped winders, complying with Section 1009.3, differing from rectangular treads in the same stairway flight.

Where the bottom or top riser adjoins a sloping public way, walkway or driveway having an established grade and

serving as a landing, the bottom or top riser is permitted to be reduced along the slope to less than 4 inches (102 mm) in height, with the variation in height of the bottom or top riser not to exceed one unit vertical in 12 units horizontal (8.333-percent slope) of stairway width. The nosings or leading edges of treads at such nonuniform height risers shall have a distinctive marking stripe, different from any other nosing marking provided on the stair flight. The distinctive marking stripe shall be visible in descent of the stair and shall have a slip-resistant surface. Marking stripes shall have a width of at least 1 inch (25 mm) but not more than 2 inches (51 mm).

1009.3.3 Profile. The radius of curvature at the leading edge of the tread shall be not greater than 0.5 inch (12.7 mm). Beveling of nosings shall not exceed 0.5 inch (12.7 mm). Risers shall be solid and vertical or sloped from the underside of the leading edge of the tread above at an angle not more than 30 degrees (0.52 rad) from the vertical. The leading edge (nosings) of treads shall project not more than 1.25 inches (32 mm) beyond the tread below and all projections of the leading edges shall be of uniform size, including the leading edge of the floor at the top of a flight.

Exceptions:

1. Solid risers are not required for stairways that are not required to comply with Section 1007.3, provided that the opening between treads does not permit the passage of a sphere with a diameter of 4 inches (102 mm).
2. Solid risers are not required for occupancies in Group I-3.

1009.3.4 Tread slope shall not be more than $^1/_4$ inch per foot (21 mm/m).

1009.4 Stairway landings. There shall be a floor or landing at the top and bottom of each stairway. The width of landings shall not be less than the width of stairways they serve. Every landing shall have a minimum dimension measured in the direction of travel equal to the width of the stairway. Such dimension need not exceed 48 inches (1219 mm) where the stairway has a straight run.

Exceptions:

1. Aisle stairs complying with Section 1024.
2. Doors opening onto a landing shall not reduce the landing to less than one-half the required width. When fully open, the door shall not project more than 7 inches (178 mm) into a landing.
3. In one- and two-family dwellings, a door at the top of a stair shall be permitted to open directly at a stair, provided the door does not swing over the stair and the door serves an area with an occupant load of fewer than 50 persons.

1009.5 Stairway construction. All stairways shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be permitted for all types of construction.

1009.5.1 Stairway walking surface. The walking surface of treads and landings of a stairway shall not be sloped steeper than one unit vertical in 50 units horizontal (2-percent slope) in any direction. Stairway treads and landings shall have a solid surface. Finish floor surfaces shall be securely attached.

Exception: In Group F, H and S occupancies, other than areas of parking structures accessible to the public, openings in treads and landings shall not be prohibited provided a sphere with a diameter of 1.125 inches (29 mm) cannot pass through the opening.

1009.5.2 Outdoor conditions. Outdoor stairways and outdoor approaches to stairways shall be designed so that water will not accumulate on walking surfaces.

1009.5.3 Enclosures under stairways. The walls and soffits within enclosed usable spaces under enclosed and unenclosed stairways shall be protected by 1-hour fire-resistance-rated construction or the fire-resistance rating of the stairway enclosure, whichever is greater. Access to the enclosed space shall not be directly from within the stair enclosure.

Exception: Spaces under stairways serving and contained within a single residential dwelling unit in Group R-2 or R-3 shall be permitted to be protected on the enclosed side with 0.5-inch (12.7 mm) gypsum board.

There shall be no enclosed usable space under exterior exit stairways unless the space is completely enclosed in 1-hour fire-resistance-rated construction. The open space under exterior stairways shall not be used for any purpose.

1009.5.4 Stair identification. An approved sign shall be located at each floor level landing in all enclosed stairways of buildings four or more stories in height. The sign shall indicate the floor level and the availability of roof access from that stairway and an identification of the stairway. The sign shall also state the floor level of and direction to exit discharge. The sign shall be located approximately 5 feet (1524 mm) above the floor landing in a position which is readily visible when the door is in the open or closed position. The floor level designation shall also be tactile in accordance with Chapter 11.

1009.6 Vertical rise. A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

Exception: Aisle stairs complying with Section 1025.

1009.7 Curved stairways. Curved stairways with winder treads shall have treads and risers in accordance with Section 1009.3 and the smallest radius shall not be less than twice the required width of the stairway.

Exceptions:

1. The radius restriction shall not apply to curved stairways for occupancies in Group R-3 and within individual dwelling units in occupancies in Group R-2.
2. In Group R-3 occupancies, circular stairs may have a minimum tread depth of 9 inches (229 mm) with 1 inch (25.4 mm) of nosing, and the smaller radius may be less than twice the width of the stairway.

1009.8 Spiral stairways. Where permitted by this section or in specific occupancies in accordance with Sections 1024 and 1026 through 1033, spiral stairs complying with this section shall be permitted as a component in a means of egress.

1009.8.1 Spiral stairs complying with the following shall be permitted:

1. Riser heights shall not exceed 7 inches (178 mm).
2. The stairway shall have a tread depth of not less than 11 inches (279 mm) for a portion of the stairway width sufficient to provide the egress capacity for the occupant load served in accordance with Section 1004.1.
3. At the outer side of the stairway, an additional $10^1/_2$ inches (267 mm) of width shall be provided clear to the other handrail, and this width shall not be included as part of the required egress capacity.
4. Handrails complying with Section 1009.11 shall be provided on both sides of the spiral stairway.
5. The inner handrail shall be located within 24 inches (610 mm), measured horizontally, of the point where a tread depth not less than 11 inches (279 mm) is provided.
6. The turn of the stairway shall be such that descending users have the outer handrail at their right side.

1009.8.2 Where the occupant load served does not exceed three and from mezzanines not exceeding 250 square feet (23 m^2) and an occupant load of three or less, spiral stairs meeting the following conditions shall be permitted:

1. The clear width of the stairs shall be not less than 26 inches (660 mm).
2. The height of the risers shall not exceed $9^1/_2$ inches (241 mm).
3. Headroom shall be not less than 6 feet 6 inches (1981 mm).
4. Treads shall have a depth not less than $7^1/_2$ inches (191 mm) at a point 12 inches (305 mm) from the narrower edge.
5. All treads shall be identical.
6. Handrails complying with Section 1009.11 shall be provided on both sides of the spiral stairway.

1009.8.3 Within dwellings and dwelling units, guest rooms and guest suites where the occupant load served does not exceed five, spiral stairs meeting the following conditions shall be permitted:

1. The minimum stairway width shall be 26 inches (660 mm).
2. The height of risers shall not be more than 9½ inches (241 mm).
3. The headroom shall be a minimum of 6 feet 6 inches (1981 mm).
4. Treads shall have a depth not less than 7½ inches (190 mm) at a point 12 inches (305 mm) from the narrow edge.
5. All treads shall be identical.
6. Handrails shall be provided on one side.

1009.9 Alternating tread devices. Alternating tread devices are limited to an element of a means of egress in buildings of Groups F, H and S from a mezzanine not more than 250 square feet (23 m^2) in area and which serves not more than three occupants; in buildings of Group I-3 from a guard tower, observation station or control room not more than 250 square feet (23 m^2) in area and for access to unoccupied roofs.

1009.9.1 Handrails of alternating tread devices. Handrails shall be provided on both sides of alternating tread devices and shall comply with Section 1012.

1009.9.2 Treads of alternating tread devices. Alternating tread devices shall have a minimum projected tread of 5 inches (127 mm), a minimum tread depth of 8.5 inches (216 mm), a minimum tread width of 7 inches (178 mm) and a maximum riser height of 9.5 inches (241 mm). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

Exception: Alternating tread devices used as an element of a means of egress in buildings from a mezzanine area not more than 250 square feet (23 m^2) in area which serves not more than five occupants shall have a minimum projected tread of 8.5 inches (216 mm) with a minimum tread depth of 10.5 inches (267 mm). The rise to the next alternating tread surface should not be more than 8 inches (203 mm).

1009.10 Handrails. Stairways shall have handrails on each side and shall comply with Section 1012. Where glass is used to provide the handrail, the handrail shall also comply with Section 2407.

Exceptions:

1. Aisle stairs complying with Section 1025 provided with a center handrail need not have additional handrails.
2. Stairways within dwelling units, spiral stairways and aisle stairs serving seating only on one side are permitted to have a handrail on one side only.
3. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require handrails.
4. In Group R-3 occupancies, a change in elevation consisting of a single riser at an entrance or egress door does not require handrails.
5. In one- and two-family dwellings and within dwelling units in Group R-2 occupancies, stairways having four or more risers above a floor or finished ground level shall be equipped with handrails located not less than 34 inches (864 mm) or more than 38 inches (965 mm) above the leading edge of a tread.

1009.11 Access to roof. Buildings four stories or more in height, except those with a roof slope greater than 4:12, shall be provided with a stairway to the roof. Such stairway shall be marked at street and floor levels with a sign indicating that it

continues to the roof. Where roofs are used for roof gardens or for other purposes, stairways shall be provided as required for such use or occupancy.

1009.11.1 Roof access. Reserved.

1009.12 Interlocking or scissor stairs shall comply with Sections 1009.12.1 and 1009.12.2.

1009.12.1 New interlocking or scissor stairs shall be permitted to be considered only as a single exit.

1009.12.2 Existing interlocking or scissor stairs shall be permitted to be considered separate exits if they meet the following criteria:

1. They are enclosed in accordance with Section 1019.
2. They are separated from each other by 2-hour fire-resistance-rated noncombustible construction.
3. No protected or unprotected penetrations or communicating openings exist between the stair enclosures.

1009.13 Accessible stairs. Stairs required to be accessible by Section 11-4.1 shall comply with Section 11-4.9. Floor surfaces of stairs along accessible routes and in accessible rooms and spaces shall comply with Section 11-4.5.

SECTION 1010
RAMPS

1010.1 Scope. The provisions of this section shall apply to ramps used as a component of a means of egress.

Exceptions:

1. Other than ramps that are part of the accessible routes providing access in accordance with Sections 11-4.7 through 11-4.8, ramped aisles within assembly rooms or spaces shall conform with the provisions in Section 1025.11.
2. Curb ramps shall comply with ICC A117.1.
3. Vehicle ramps in parking garages for pedestrian exit access shall not be required to comply with Sections 11-4.7 through 11.4-8 when they are not an accessible route serving accessible parking spaces, other required accessible elements or part of an accessible means of egress.

1010.2 Slope. Ramps used as part of a means of egress shall have a running slope not steeper than one unit vertical in 12 units horizontal (8.333-percent slope). The slope of other ramps shall not be steeper than one unit vertical in eight units horizontal (12.5-percent slope).

Exceptions:

1. Aisle ramp slope in occupancies of Group A shall comply with Section 1024.11.
2. Ramps that provide access to vehicles, vessels, mobile structures and aircraft shall not be required to comply with the maximum slope or maximum rise for a single ramp run.

1010.3 Cross slope. The slope measured perpendicular to the direction of travel of a ramp shall not be steeper than one unit vertical in 50 units horizontal (2-percent slope).

1010.4 Vertical rise. The rise for any ramp run shall be 30 inches (762 mm) maximum.

1010.5 Minimum dimensions. The minimum dimensions of means of egress ramps shall comply with Sections 1010.5.1 through 1010.5.3.

1010.5.1 Width. The minimum width of a means of egress ramp shall not be less than that required for corridors by Section 1017.2. The clear width of a ramp and the clear width between handrails, if provided, shall be 36 inches (914 mm) minimum.

Exception: Ramps that are part of a required means of egress shall not be less than 44 inches (1118 mm) wide.

1010.5.2 Headroom. The minimum headroom in all parts of the means of egress ramp shall not be less than 80 inches (2032 mm).

1010.5.3 Restrictions. Means of egress ramps shall not reduce in width in the direction of egress travel. Projections into the required ramp and landing width are prohibited. Doors opening onto a landing shall not reduce the clear width to less than 42 inches (1067 mm).

1010.6 Landings. Ramps shall have landings at the bottom and top of each ramp, points of turning, entrance, exits, at doors and in accordance with Section 11- 4.8.4. Landings shall comply with Sections 1010.6.1 through 1010.6.5.

1010.6.1 Slope. Landings shall have a slope not steeper than one unit vertical in 50 units horizontal (2-percent slope) in any direction. Changes in level are not permitted.

1010.6.2 Width. The landing shall be at least as wide as the widest ramp run adjoining the landing.

1010.6.3 Length. The landing length shall be 60 inches (1525 mm) minimum.

Exceptions:

1. Landings in nonaccessible Group R-2 and R-3 individual dwelling units are permitted to be 36 inches (914 mm) minimum.
2. Where the ramp is not a part of an accessible route, the length of the landing shall not be required to be more than 48 inches (1220 mm) in the direction of travel.
3. Accessible landings shall comply with Section 11-4.8.4.

1010.6.4 Change in direction. Where changes in direction of travel occur at landings provided between ramp runs, the landing shall be 60 inches by 60 inches (1524 mm by 1524 mm) minimum.

Exception: Landings in nonaccessible Group R-2 and R-3 individual dwelling units are permitted to be 36 inches by 36 inches (914 mm by 914 mm) minimum.

1010.6.5 Doorways. Where doorways are located adjacent to a ramp landing, maneuvering clearances required by ICC A117.1 are permitted to overlap the required landing area.

1010.7 Ramp construction. All ramps shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be

permitted for all types of construction. Ramps used as an exit shall conform to the applicable requirements of Sections 1020.1 through 1020.1.3 for exit enclosures.

1010.7.1 Ramp surface. The surface of ramps shall be of slip-resistant materials that are securely attached.

1010.7.2 Outdoor conditions. Outdoor ramps and outdoor approaches to ramps shall be designed so that water will not accumulate on walking surfaces.

1010.7.3 All ramps that serve as required means of egress shall be of permanent, fixed construction.

1010.7.4 The ramp floor and landings shall be solid and without perforations.

1010.8 Handrails. Handrails shall be provided along both sides of a ramp run with a rise greater than 6 inches (152 mm) and shall conform to the requirements in Section 1009.11. If handrails are not continuous, they shall extend at least 18 inches (305 mm) beyond the top and bottom of the ramp segment and shall be parallel with the floor or ground surface. Ends of handrails shall be either rounded or returned smoothly to floor, wall or post. Handrails shall not rotate within their fittings. Top of the handrail gripping surface shall be not less than 34 inches (864 mm) nor more than 38 inches (965 mm) above the ramp surface.

Exceptions:

1. Handrails are not required when the total ramp run rise is 6 inches (152 mm) or less and the horizontal projection is 72 inches or less, except where required to be accessible.
2. Aisles in Group A occupancies (see Section 1024).
3. In dwelling units not required to be accessible by Chapter 11, handrails are not required to extend beyond the top and bottom of the ramp segment.
4. Handrails are not required on curb ramps.

1010.9 Edge protection. Edge protection complying with Section 1010.9.1 or 1010.9.2 shall be provided on each side of ramp runs and at each side of ramp landings.

Exceptions:

1. Edge protection is not required on ramps that are not required to have handrails, provided they have flared sides that comply with Section 11-4.8.7, curb ramp.
2. Edge protection is not required on the sides of ramp landings serving an adjoining ramp run or stairway.
3. Edge protection is not required on the sides of ramp landings having a vertical dropoff of not more than 0.5 inch (12.7 mm) within 10 inches (254 mm) horizontally of the required landing area.

1010.9.1 Curb, rail, wall or barrier. A curb, rail, wall or barrier shall be provided that prevents the passage of a 4-inch-diameter (102 mm) sphere, where any portion of the sphere is within 4 inches (102 mm) of the floor or ground surface.

1010.9.2 Extended floor or ground surface. The floor or ground surface of the ramp run or landing shall extend 12 inches (305 mm) minimum beyond the inside face of a handrail complying with Section 1012.

1010.10 Guards. Guards shall be provided where required by Section 1013 and shall be constructed in accordance with Section 1013.

SECTION 1011
EXIT SIGNS

1011.1 Where required. See Section 1006.3.

SECTION 1012
HANDRAILS

1012.1 Where required. Handrails for stairways and ramps shall be adequate in strength and attachment in accordance with Section 1607.7. Handrails required for stairways by Section 1009.10 shall comply with Sections 1012.2 through 1012.8. Handrails required for ramps by Section 1010.8 shall comply with Sections 1012.2 through 1012.7.

1012.2 Height. Handrail height, measured above stair tread nosings, or finish surface of ramp slope shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

Exception: Handrails for stairs not required to be accessible that form part of a guardrail may be 42 inches (1067 mm) high.

1012.3 Handrail graspability. Handrails with a circular cross-section shall have an outside diameter of at least 1.25 inches (51 mm) and not greater than 2 inches (51 mm) or shall provide equivalent graspability. If the handrail is not circular, it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than 6.25 inches (160 mm) with a maximum cross-section dimension of 2.25 inches (57 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

Exception: Accessible handrails shall meet the requirements of Section 11-4.26.2.

1012.4 Continuity. Handrail-gripping surfaces shall be continuous, without interruption by newel posts or other obstructions.

Exceptions:

1. Handrails within dwelling units are permitted to be interrupted by a newel post at a stair or ramp landing.
2. Within a dwelling unit, the use of a volute, turnout or starting easing is allowed on the lowest tread.
3. Handrail brackets or balusters attached to the bottom surface of the handrail shall not be considered obstructions to graspability, provided that the following conditions are met:
   3.1. They do not project horizontally beyond the sides of the handrail within $1^1/_2$ inches (38 mm) of the bottom of the handrail and provided that, for each $^1/_2$ inch (12.7 mm) of additional handrail perimeter dimension above 4 inches (102 mm), the vertical clearance dimension of 1½ inches (38 mm) can be reduced by $^1/_8$ inch (.3 mm).

3.2. They have edges with a radius of not less than .01 inch (0.25 mm).

3.3. They obstruct not in excess of 20 percent of the handrail length.

1012.5 Handrail extensions. Handrails shall return to a wall, guard or the walking surface or shall be continuous to the handrail of an adjacent stair flight or ramp run. At stairways where handrails are not continuous between flights, the handrails shall extend horizontally at least 12 inches (305 mm) beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. At ramps where handrails are not continuous between runs, the handrails shall extend horizontally above the landing 12 inches (305 mm) minimum beyond the top and bottom of ramp runs.

Exceptions:

1. Handrails within a dwelling unit that is not required to be accessible need extend only from the top riser to the bottom riser.
2. Aisle handrails in Group A occupancies in accordance with Section 1025.13.
3. Accessible handrail extensions shall be as per Section 11-4.8.5(2).

1012.6 Clearance. Clear space between a handrail and a wall or other surface shall be a minimum of 1.5 inches (38 mm). A handrail and a wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements.

Exception: Accessible handrails shall comply with Section 11-4.8.5(3).

1012.7 Projections. On ramps, the clear width between handrails shall be 36 inches (914 mm) minimum. Projections into the required width of stairways and ramps at each handrail shall not exceed 4.5 inches (114 mm) at or below the handrail height. Projections into the required width shall not be limited above the minimum headroom height required in Section 1009.2.

1012.8 Intermediate handrails. Handrails shall be provided within 30 inches (762 mm) of all portions of the stair width required for egress capacity in accordance with Table 1005.1. The required egress width shall be along the natural path of travel.

1012.8.1 Where new intermediate handrails are provided in accordance with Section 1012.8, the minimum clear width between handrails shall be 20 inches (510 mm).

1012.9 For provisions related to handrails on stairs which are required to be accessible, refer to Sections 11-4.9.1 and 11-4.9.4.

SECTION 1013
GUARDS

1013.1 Where required. Guards shall be located along open-sided walking surfaces, mezzanines, industrial equipment platforms, stairways, ramps and landings that are located more than 30 inches (762 mm) above the floor or grade below. Guards shall be adequate in strength and attachment in accordance with Section 1607.7. Where glass is used to provide a guard or as a portion of the guard system, the guard shall also comply with Section 2407. Guards shall also be located along glazed sides of stairways, ramps and landings that are located more than 30 inches (762 mm) above the floor or grade below where the glazing provided does not meet the strength and attachment requirements in Section 1607.7.

Exception: Guards are not required for the following locations:

1. On the loading side of loading docks or piers.
2. On the audience side of stages and raised platforms, including steps leading up to the stage and raised platforms.
3. On raised stage and platform floor areas, such as runways, ramps and side stages used for entertainment or presentations.
4. At vertical openings in the performance area of stages and platforms.
5. At elevated walking surfaces appurtenant to stages and platforms for access to and utilization of special lighting or equipment.
6. Along vehicle service pits not accessible to the public.
7. In assembly seating where guards in accordance with Section 1025.14 are permitted and provided.

1013.2 Height. Guards shall form a protective barrier not less than 42 inches (1067 mm) high, measured vertically above the leading edge of the tread, adjacent walking surface or adjacent seatboard.

Exceptions:

1. For occupancies in Group R-3, and within individual dwelling units in occupancies in Group R-2, guards whose top rail also serves as a handrail shall have a height not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from the leading edge of the stair tread nosing.
2. The height in assembly seating areas shall be in accordance with Section 1025.14.

1013.3 Opening limitations. Open guards shall have balusters or ornamental patterns such that a 4-inch-diameter (102 mm) sphere cannot pass through any opening up to a height of 34 inches (864 mm). From a height of 34 inches (864 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, a sphere 8 inches (203 mm) in diameter shall not pass.

Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail at the open side of a stairway shall be of a maximum size such that a sphere of 6 inches (152 mm) in diameter cannot pass through the opening.
2. At elevated walking surfaces for access to and use of electrical, mechanical or plumbing systems or equipment, guards shall have balusters or be of solid materials such that a sphere with a diameter of 21 inches (533 mm) cannot pass through any opening.
3. In areas that are not open to the public within occupancies in Group I-3, F, H or S, balusters, horizontal intermediate rails or other construction shall not per-

mit a sphere with a diameter of 21 inches (533 mm) to pass through any opening.

4. In assembly seating areas, guards at the end of aisles where they terminate at a fascia of boxes, balconies and galleries shall have balusters or ornamental patterns such that a 4-inch-diameter (102 mm) sphere cannot pass through any opening up to a height of 26 inches (660 mm). From a height of 26 inches (660 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, a sphere 8 inches (203 mm) in diameter shall not pass.
5. Within individual dwelling units and sleeping units in Group R-2 and R-3 occupancies, openings for required guards on the sides of stair treads shall not allow a sphere of 4.375 inches (111 mm) to pass through.

1013.4 Screen porches. Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

1013.5 Mechanical equipment. Guards shall be provided where appliances, equipment, fans, roof hatch openings or other components that require service are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere. The guard shall extend not less than 30 inches (762 mm) beyond each end of such appliance, equipment, fan or component.

1013.6 Roof access. Guards shall be provided where the roof hatch opening is located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere.

SECTION 1014
EXIT ACCESS

1014.1 General. The exit access arrangement shall comply with Sections 1014 through 1017 and the applicable provisions of Sections 1003 through 1013.

1014.2 Egress through intervening spaces. Egress through intervening spaces shall comply with this section.

1. Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas are accessory to the area served, are not a high-hazard occupancy and provide a discernible path of egress travel to an exit.

   Exception: Means of egress are not prohibited through adjoining or intervening rooms or spaces in a Group H, S or F occupancy when the adjoining or intervening rooms or spaces are the same or a lesser hazard occupancy group.
2. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes.

   Exceptions:

   1. Means of egress are not prohibited through a kitchen area serving adjoining rooms constituting part of the same dwelling unit or sleeping unit.
   2. Means of egress are not prohibited through stockrooms in Group M occupancies when all of the following are met:
      2.1. The stock is of the same hazard classification as that found in the main retail area;
      2.2. Not more than 50 percent of the exit access is through the stockroom;
      2.3. The stockroom is not subject to locking from the egress side; and
      2.4. There is a demarcated, minimum 44-inch-wide (1118 mm) aisle defined by full or partial height fixed walls or similar construction that will maintain the required width and lead directly from the retail area to the exit without obstructions.
   3. An exit access shall not pass through a room that can be locked to prevent egress.
   4. Means of egress from dwelling units or sleeping areas shall not lead through other sleeping areas, toilet rooms or bathrooms.

1014.2.1 Multiple tenants. Where more than one tenant occupies any one floor of a building or structure, each tenant space, dwelling unit and sleeping unit shall be provided with access to the required exits without passing through adjacent tenant spaces, dwelling units and sleeping units.

Exception: Means of egress shall not be prohibited through adjoining tenant space where such rooms or spaces occupy less than 10 percent of the area of the tenant space through which they pass; are the same or similar occupancy group; a discernable path of egress travel to an exit is provided; and the means of egress into the adjoining space is not subject to locking from the egress side. A required means of egress serving the larger tenant space shall not pass through the smaller tenant space or spaces.

1014.2.2 Group I-2. Habitable rooms or suites in Group I-2 occupancies shall have an exit access door leading directly to a corridor.

Exceptions:

1. Rooms with exit doors opening directly to the outside at ground level.
2. Patient sleeping rooms are permitted to have one intervening room if the intervening room is not used as an exit access for more than eight patient beds.
3. Special nursing suites are permitted to have one intervening room where the arrangement allows

for direct and constant visual supervision by nursing personnel.

4. For rooms other than patient sleeping rooms located within a suite, exit access travel from within the suite shall be permitted through one intervening room where the travel distance to the exit access door is not greater than 100 feet (30 480 mm).
5. For rooms other than patient sleeping rooms located within a suite, exit access travel from within the suite shall be permitted through two intervening rooms where the travel distance to the exit access door is not greater than 50 feet (15 240 mm).

Suites of sleeping rooms shall not exceed 5,000 square feet (465 m^2). Suites of rooms other than patient sleeping rooms shall not exceed 10,000 square feet (929 m^2). Any patient sleeping room, or any suite that includes patient sleeping rooms, of more than 1,000 square feet (93 m^2) shall have at least two exit access doors remotely located from each other. Any room or suite of rooms other than patient sleeping rooms of more than 2,500 square feet (232 m^2) shall have at least two access doors remotely located from each other. The travel distance between any point in a Group I-2 occupancy and an exit access door in the room shall not exceed 50 feet (15 240 mm). The travel distance between any point in a suite of sleeping rooms and an exit access door of that suite shall not exceed 100 feet (30 480 mm).

1014.3 Common path of egress travel. In occupancies other than Groups H-1, H-2 and H-3, the common path of egress travel shall not exceed 75 feet (22 860 mm). In Group H-1, H-2 and H-3 occupancies, the common path of egress travel shall not exceed 25 feet (7620 mm). For common path of egress travel in Group A occupancies having fixed seating, see Section 1025.8.

Exceptions:

1. The length of a common path of egress travel in Group B, F, M and S occupancies shall not be more than 100 feet (30 480 mm), provided that the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. Where a tenant space in Group B, S and U occupancies has an occupant load of not more than 30, the length of a common path of egress travel shall not be more than 100 feet (30 480 mm).
3. The length of a common path of egress travel in a Group I-3 occupancy shall not be more than 100 feet (30 480 mm).
4. the length of a common path of egress travel in a Group R-2 occupancy shall not be more than 125 feet (38 100 mm), within the dwelling unit, provided that the building is protected throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 otherwise 75 feet.
5. Where a tenant space in Group A occupancy has an occupant load of more than 50, the length of a common path of egress travel shall not be more than 20 feet (6098 mm).
6. The common path of egress travel in Group R1 and R2 occupancies shall not exceed 35 feet (10 668 mm). Travel within a guestroom, guest suite or dwelling unit shall not be included when calculating the common path of travel. The common path of egress travel in occupancy Groups R1 and R2 shall not exceed 50 feet (15 240 mm) provided the building is protected throughout by an approved, automatic sprinkler system in accordance with Section 903.3.1.1.
7. The common path of egress travel in occupancies in Group F and S shall be 50 feet (15 240 mm) in unsprinklered buildings.
8. The common path of egress travel in Group S2 parking garages shall be 50 feet (15 240 mm).
9. In occupancy Group S2 common paths of egress travel shall not be limited.
10. In occupancy Group H common paths of egress travel shall be prohibited.

1014.4 Aisles. Aisles serving as a portion of the exit access in the means of egress system shall comply with the requirements of this section. Aisles shall be provided from all occupied portions of the exit access which contain seats, tables, furnishings, displays and similar fixtures or equipment. Aisles serving assembly areas, other than seating at tables, shall comply with Section 1025. Aisles serving reviewing stands, grandstands and bleachers shall also comply with Section 1025.

The required width of aisles shall be unobstructed.

Exception: Doors, when fully opened, and handrails shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one-half. Other nonstructural projections such as trim and similar decorative features are permitted to project into the required width 1.5 inches (38 mm) from each side.

1014.4.1 Aisles in Groups B and M. In Group B and M occupancies, the minimum clear aisle width shall be determined by Section 1005.1 for the occupant load served, but shall not be less than 36 inches (914 mm).

Exception: Nonpublic aisles serving less than 50 people and not required to be accessible by Chapter 11 need not exceed 28 inches (711 mm) in width.

1014.4.2 Aisle accessways in Group M. An aisle accessway shall be provided on at least one side of each element within the merchandise pad. The minimum clear width for an aisle accessway not required to be accessible shall be 30 inches (762 mm). The required clear width of the aisle accessway shall be measured perpendicular to the elements and merchandise within the merchandise pad. The 30-inch (762 mm) minimum clear width shall be maintained to provide a path to an adjacent aisle or aisle accessway. The common path of travel shall not exceed 30 feet (9144 mm) from any point in the merchandise pad.

Exception: For areas serving not more than 50 occupants, the common path of travel shall not exceed 75 feet (22 880 mm).

1014.4.3 Seating at tables. Where seating is located at a table or counter and is adjacent to an aisle or aisle accessway, the measurement of required clear width of the aisle or aisle accessway shall be made to a line 19 inches (483 mm) away from and parallel to the edge of the table or counter. The 19-inch (483 mm) distance shall be measured perpendicular to the side of the table or counter. In the case of other side boundaries for aisle or aisle accessways, the clear width shall be measured to walls, edges of seating and tread edges, except that handrail projections are permitted.

Exception: Where tables or counters are served by fixed seats, the width of the aisle accessway shall be measured from the back of the seat.

1014.4.3.1 Aisle accessway for tables and seating. Aisle accessways serving arrangements of seating at tables or counters shall have sufficient clear width to conform to the capacity requirements of Section 1005.1 but shall not have less than the appropriate minimum clear width specified in Section 1014.4.3.2.

1014.4.3.2 Table and seating accessway width. Aisle accessways shall provide a minimum of 12 inches (305 mm) of width plus 0.5 inch (12.7 mm) of width for each additional 1 foot (305 mm), or fraction thereof, beyond 12 feet (3658 mm) of aisle accessway length measured from the center of the seat farthest from an aisle.

Exception: Portions of an aisle accessway having a length not exceeding 6 feet (1829 mm) and used by a total of not more than four persons.

1014.4.3.3 Table and seating aisle accessway length. The length of travel along the aisle accessway shall not exceed 30 feet (9144 mm) from any seat to the point where a person has a choice of two or more paths of egress travel to separate exits.

1014.5 Egress balconies. Balconies used for egress purposes shall conform to the same requirements as corridors for width, headroom, dead ends and projections.

1014.5.1 Wall separation. Exterior egress balconies shall be separated from the interior of the building by walls and opening protectives as required for corridors.

Exception: Separation is not required where the exterior egress balcony is served by at least two stairs and a dead-end travel condition does not require travel past an unprotected opening to reach a stair.

1014.5.2 Openness. The long side of an egress balcony shall be at least 50 percent open, and the open area above the guards shall be so distributed as to minimize the accumulation of smoke or toxic gases.

SECTION 1015
EXIT AND EXIT ACCESS DOORWAYS

1015.1 Exit or exit access doorways required. Two exits or exit access doorways from any space shall be provided where one of the following conditions exists:

1. The occupant load of the space exceeds the values in Table 1015.1.
2. The common path of egress travel exceeds the limitations of Section 1014.3.
3. Where required by Sections 1015.3, 1015.4 and 1015.5.

Exception: Group I-2 occupancies shall comply with Section 1014.2.2.

TABLE 1015.1
SPACES WITH ONE MEANS OF EGRESS

OCCUPANCY	MAXIMUM OCCUPANT LOAD
A, B, D, E, F, M, U, R-2, R-3	49
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, R-1, R-4	10
S	29

a. Day care maximum occupant load is 10.

1015.1.1 Three or more exits. Access to three or more exits shall be provided from a floor area where required by Section 1019.1.

1015.2 Exit or exit access doorway arrangement. Required exits shall be located in a manner that makes their availability obvious. Exits shall be unobstructed at all times. Exit and exit access doorways shall be arranged in accordance with Sections 1015.2.1 and 1015.2.2.

1015.2.1 Two exits or exit access doorways. Where two exits or exit access doorways are required from any portion of the exit access, the exit doors or exit access doorways shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exit doors or exit access doorways. Interlocking or scissor stairs shall be counted as one exit stairway.

Exceptions:

1. Where exit enclosures are provided as a portion of the required exit and are interconnected by a 1-hour fire-resistance-rated corridor conforming to the requirements of Section 1017, the required exit separation shall be measured along the shortest direct line of travel within the corridor.
2. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, the separation distance of the exit doors or exit access doorways shall not be less than one-third of the length of the maximum overall diagonal dimension of the area served.
3. In Group R-1 and R-2 occupancies, the distance between exits is not applicable to common

nonlooped exit access corridors in a building that has corridor doors from the guestroom or guest suite or dwelling unit, which are arranged so that the exits are located in opposite directions from such doors.

1015.2.2 Three or more exits or exit access doorways. Where access to three or more exits is required, at least two exit doors or exit access doorways shall be arranged in accordance with the provisions of Section 1015.2.1.

1015.3 Boiler, incinerator and furnace rooms. Two exit access doorways are required in boiler, incinerator and furnace rooms where the area is over 500 square feet (46 m^2) and any fuel-fired equipment exceeds 400,000 British thermal units (Btu) (422 000 KJ) input capacity. Where two exit access doorways are required, one is permitted to be a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the length of the maximum overall diagonal dimension of the room.

1015.4 Refrigeration machinery rooms. Machinery rooms larger than 1,000 square feet (93 m^2) shall have not less than two exits or exit access doors. Where two exit access doorways are required, one such doorway is permitted to be served by a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the maximum horizontal dimension of room.

All portions of machinery rooms shall be within 150 feet (45 720 mm) of an exit or exit access doorway. An increase in travel distance is permitted in accordance with Section 1016.1.

Doors shall swing in the direction of egress travel, regardless of the occupant load served. Doors shall be tight fitting and self-closing.

1015.5 Refrigerated rooms or spaces. Rooms or spaces having a floor area of 1,000 square feet (93 m^2) or more, containing a refrigerant evaporator and maintained at a temperature below 68°F (20°C), shall have access to not less than two exits or exit access doors.

Travel distance shall be determined as specified in Section 1016.1, but all portions of a refrigerated room or space shall be within 150 feet (45 720 mm) of an exit or exit access door where such rooms are not protected by an approved automatic sprinkler system. Egress is allowed through adjoining refrigerated rooms or spaces.

Exception: Where using refrigerants in quantities limited to the amounts based on the volume set forth in the *Florida Building Code, Mechanical.*

1015.6 Stage means of egress. Where two means of egress are required, based on the stage size or occupant load, one means of egress shall be provided on each side of the stage.

1015.6.1 Gallery, gridiron and catwalk means of egress. The means of egress from lighting and access catwalks, galleries and gridirons shall meet the requirements for occupancies in Group F-2.

Exceptions:

1. A minimum width of 22 inches (559 mm) is permitted for lighting and access catwalks.
2. Spiral stairs are permitted in the means of egress.
3. Stairways required by this subsection need not be enclosed.
4. Stairways with a minimum width of 22 inches (559 mm), ladders, or spiral stairs are permitted in the means of egress.
5. A second means of egress is not required from these areas where a means of escape to a floor or to a roof is provided. Ladders, alternating tread devices or spiral stairs are permitted in the means of escape.
6. Ladders are permitted in the means of egress.

SECTION 1016
EXIT ACCESS TRAVEL DISTANCE

1016.1 Travel distance limitations. Exits shall be so located on each story such that the maximum length of exit access travel, measured from the most remote point within a story to the entrance to an exit along the natural and unobstructed path of egress travel, shall not exceed the distances given in Table 1016.1.

Where the path of exit access includes unenclosed stairways or ramps within the exit access or includes unenclosed exit ramps or stairways as permitted in Section 1020.1, the distance of travel on such means of egress components shall also be included in the travel distance measurement. The measurement along stairways shall be made on a plane parallel and tangent to the stair tread nosings in the center of the stairway.

Exceptions:

1. Travel distance in open parking garages is permitted to be measured to the closest riser of open stairs.
2. In outdoor facilities with open exit access components and open exterior stairs or ramps, travel distance is permitted to be measured to the closest riser of a stair or the closest slope of the ramp.
3. Where an exit stair is permitted to be unenclosed in accordance with Exception 8 or 9 of Section 1020.1, the travel distance shall be measured from the most remote point within a building to an exit discharge.

1016.2 Roof vent increase. In buildings that are one story in height, equipped with automatic heat and smoke roof vents complying with Section 910 and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum exit access travel distance shall be 400 feet (122 m) for occupancies in Group F-1 or S-1.

1016.3 Exterior egress balcony increase. Travel distances specified in Section 1016.1 shall be increased up to an additional 100 feet (30 480 mm) provided the last portion of the exit access leading to the exit occurs on an exterior egress balcony constructed in accordance with Section 1014.5. The length of such balcony shall not be less than the amount of the increase taken.

TABLE 1016.1
EXIT ACCESS TRAVEL DISTANCE[a]

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
R[d]	100[e]	200[b]
M	150	250[c]
A, F-1, I-1	200	250[b]
B	200	300[c]
S-1	200	400[c]
F-2, S-2, U	300	400[c]
H-1	Not Permitted	75[c]
H-2	Not Permitted	100[c]
H-3	Not Permitted	150[c]
H-4	Not Permitted	175[c]
H-5	Not Permitted	200[c]
E, D, S-2[f] I-2, I-3	150	200[c]

For SI: 1 foot = 304.8 mm.

a. See the following sections for modifications to exit access travel distance requirements:
Section 402: For the distance limitation in malls.
Section 404: For the distance limitation through an atrium space.
Section 1016.2 For increased limitations in Groups F-1 and S-1.
Section 1025.7: For increased limitation in assembly seating.
Section 1025.7: For increased limitation for assembly open-air seating.
Section 1019.2: For buildings with one exit.
Chapter 31: For the limitation in temporary structures.

b. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems in accordance with Section 903.3.1.2 are permitted.

c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

d. Travel within a guestroom, guest suite or dwelling unit shall not be included when calculating the travel distance. See Section 1014.3, Exception 4 for common path within.

e. For exterior 200 feet is allowed without sprinkler.

f. Enclosed parking garage.

SECTION 1017
CORRIDORS

1017.1 Construction. Corridors shall be fire-resistance rated in accordance with Table 1017.1. The corridor walls required to be fire-resistance rated shall comply with Section 708 for fire partitions.

Exceptions:

1. A fire-resistance rating is not required for corridors in an occupancy in Group E where each room that is used for instruction has at least one door directly to the exterior and rooms for assembly purposes have at least one-half of the required means of egress doors opening directly to the exterior. Exterior doors specified in this exception are required to be at ground level.
2. A fire-resistance rating is not required for corridors contained within a dwelling or sleeping unit in an occupancy in Group R.
3. A fire-resistance rating is not required for corridors in open parking garages.
4. A fire-resistance rating is not required for corridors in an occupancy in Group B which is a space requiring only a single means of egress complying with Section 1015.1.

1017.2 Corridor width. The minimum corridor width shall be as determined in Section 1005.1, but not less than 44 inches (1118 mm).

Exceptions:

1. Twenty-four inches (610 mm)—For access to and utilization of electrical, mechanical or plumbing systems or equipment.
2. Thirty-six inches (914 mm)—With a required occupant capacity of less than 50.
3. Thirty-six inches (914 mm)—Within a dwelling unit.
4. Seventy-two inches (1829 mm)—In Group E with a corridor having a required capacity of 100 or more.

TABLE 1017.1
CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system[c]
H-1, H-2, H-3	All	1	1
A, H-4, H-5	Greater than 30	1	1
B, D, E[c], F, M, S, U	Greater than 30	1	0
R	Greater than 10	1	1
I-2[a]	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1[b]

a. For requirements for occupancies in Group I-2, see Section 407.3.

b. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

c. In buildings protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 903, corridor walls shall not be required to be rated, provided that such walls form smoke partitions in accordance with the *Florida Fire Prevention Code*.

5. Seventy-two inches (1829 mm)—In corridors serving surgical Group I, health care centers for ambulatory patients receiving outpatient medical care, which causes the patient to be not capable of self-preservation.
6. Ninety-six inches (2438 mm)—In Group I-2 in areas where required for bed movement.

1017.3 Dead ends. Where more than one exit or exit access doorway is required, the exit access shall be arranged such that there are no dead ends in corridors more than 20 feet (6096 mm) in length.

Exceptions:

1. In occupancies in Group I-3 of Occupancy Condition 2, 3 or 4 (see Section 308.4), the dead end in a corridor shall not exceed 50 feet (15 240 mm).
2. In occupancies in Groups B and F where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the length of dead-end corridors shall not exceed 50 feet (15 240 mm).
3. A dead-end corridor shall not be limited in length where the length of the dead-end corridor is less than 2.5 times the least width of the dead-end corridor.

1017.4 Air movement in corridors. Corridors shall not serve as supply, return, exhaust, relief or ventilation air ducts.

Exceptions:

1. Use of a corridor as a source of makeup air for exhaust systems in rooms that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, smoking lounges and janitor closets, shall be permitted, provided that each such corridor is directly supplied with outdoor air at a rate greater than the rate of makeup air taken from the corridor.
2. Where located within a dwelling unit, the use of corridors for conveying return air shall not be prohibited.
3. Where located within tenant spaces of 1,000 square feet (93 m^2) or less in area, utilization of corridors for conveying return air is permitted.

1017.4.1 Corridor ceiling. Use of the space between the corridor ceiling and the floor or roof structure above as a return air plenum is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction;
2. The corridor is separated from the plenum by fire-resistance-rated construction;
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by the *Florida Building Code, Mechanical.*
4. The air-handling system serving the corridor is shut down upon detection of sprinkler waterflow where the building is equipped throughout with an automatic sprinkler system; or
5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an approved engineered smoke control system.

1017.5 Corridor continuity. Fire-resistance-rated corridors shall be continuous from the point of entry to an exit, and shall not be interrupted by intervening rooms.

Exception: Foyers, lobbies or reception rooms constructed as required for corridors shall not be construed as intervening rooms.

SECTION 1018
EXITS

1018.1 General. Exits shall comply with Sections 1018 through 1023 and the applicable requirements of Sections 1003 through 1013. An exit shall not be used for any purpose that interferes with its function as a means of egress. Once a given level of exit protection is achieved, such level of protection shall not be reduced until arrival at the exit discharge.

1018.2 Exterior exit doors. Buildings or structures used for human occupancy shall have at least one exterior door that meets the requirements of Section 1008.1.1.

1018.2.1 Detailed requirements. Exterior exit doors shall comply with the applicable requirements of Section 1008.1.

1018.2.2 Arrangement. Exterior exit doors shall lead directly to the exit discharge or the public way.

SECTION 1019
NUMBER OF EXITS AND CONTINUITY

1019.1 Minimum number of exits. All rooms and spaces within each story shall be provided with and have access to the minimum number of approved independent exits required by Table 1019.1 based on the occupant load of the story, except as modified in Section 1015.1 or 1019.2. For the purposes of this chapter, occupied roofs shall be provided with exits as required for stories. The required number of exits from any story, basement or individual space shall be maintained until arrival at grade or the public way.

Exception: A fenced outdoor assembly occupancy shall have at least two widely separated means of egress from the enclosure. If more than 6,000 persons are to be served by such means of egress, there shall be at least three means of egress; if more than 9,000 persons are to be served, there shall be at least four means of egress.

TABLE 1019.1
MINIMUM NUMBER OF EXITS FOR OCCUPANT LOAD

OCCUPANT LOAD (persons per story)	MINIMUM NUMBER OF EXITS (per story)
1-500	2
501-1,000	3
More than 1,000	4

1019.1.1 Parking structures. Parking structures shall not have less than two exits from each parking tier, except that only one exit is required where vehicles are mechanically

parked. Vehicle ramps shall not be considered as required exits unless pedestrian facilities are provided.

1019.1.2 Helistops. The means of egress from helistops shall comply with the provisions of this chapter, provided that landing areas located on buildings or structures shall have two or more exits. For landing platforms or roof areas less than 60 feet (18 288 mm) long, or less than 2,000 square feet (186 m^2) in area, the second means of egress is permitted to be a fire escape or ladder leading to the floor below.

1019.2 Buildings with one exit. Only one exit shall be required in buildings as described below:

1. Buildings described in Table 1019.2, provided that the building has not more than one level below the first story above grade plane.
2. Buildings of Group R-3 occupancy.
3. Single-level buildings with the occupied space at the level of exit discharge provided that the story or space complies with Section 1015.1 as a space with one means of egress.

TABLE 1019.2
BUILDINGS WITH ONE EXIT

OCCUPANCY	MAXIMUM HEIGHT OF BUILDING ABOVE GRADE PLANE	MAXIMUM OCCUPANTS (OR DWELLING UNITS) PER FLOOR AND TRAVEL DISTANCE
A, B[d], D, E[e], F, M, U	1 Story	49 occupants and 75 feet travel distance
H-2, H-3	1 Story	3 occupants and 25 feet travel distance
H-4, H-5, I, R	1 Story	10 occupants and 75 feet travel distance
S[a]	1 Story	29 occupants and 100 feet travel distance
B[b], F, M, S[a]	2 Stories	30 occupants and 75 feet travel distance
R-2	2 Stories[c]	4 dwelling units and 50 feet travel distance

For SI: 1 foot = 304.8 mm.

a. For the required number of exits for parking structures, see Section 1019.1.1.

b. For the required number of exits for air traffic control towers, see Section 412.1.

c. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1026 shall have a maximum height of three stories above grade plane.

d. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 with an occupancy in Group B shall have a maximum travel distance of 100 feet.

e. Day care maximum occupant load is 10.

1019.3 Exit continuity. Exits shall be continuous from the point of entry into the exit to the exit discharge.

1019.4 Exit door arrangement. Exit door arrangement shall meet the requirements of Sections 1015.2 through 1015.2.2.

SECTION 1020
VERTICAL EXIT ENCLOSURES

1020.1 Enclosures required. Interior exit stairways and interior exit ramps shall be enclosed with fire barriers constructed in accordance with Section 706 or horizontal assemblies constructed in accordance with Section 711, or both. Exit enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more and not less than 1 hour where connecting less than four stories. The number of stories connected by the exit enclosure shall include any basements but not any mezzanines. An exit enclosure shall not be used for any purpose other than means of egress.

Exceptions:

1. In all occupancies, other than Group H and I occupancies, a stairway is not required to be enclosed when the stairway serves an occupant load of less than 10 and the stairway complies with either Item 1.1 or 1.2. In all cases, the maximum number of connecting open stories shall not exceed two.
   1.1. The stairway is open to not more than one story above the story at the level of exit discharge; or
   1.2. The stairway is open to not more than one story below the story at the level of exit discharge.
2. Exits in buildings of Group A-5 where all portions of the means of egress are essentially open to the outside need not be enclosed.
3. Stairways serving and contained within a single residential dwelling unit or sleeping unit in Group R-1, R-2 or R-3 occupancies are not required to be enclosed.
4. Stairways that are not a required means of egress element are not required to be enclosed where such stairways comply with Section 707.2.
5. Stairways in open parking structures that serve only the parking structure are not required to be enclosed.
6. Stairways in Group I-3 occupancies, as provided for in Section 408.3.6, are not required to be enclosed.
7. Means of egress stairways as required by Section 410.5.3 are not required to be enclosed.
8. In other than Group H and I occupancies, a maximum of 50 percent of egress stairways serving one adjacent floor are not required to be enclosed, provided at least two means of egress are provided from both floors served by the unenclosed stairways. Any two such interconnected floors shall not be open to other floors. Unenclosed exit stairways shall be remotely located as required in Section 1015.2.
9. In other than Group H and I occupancies, interior egress stairways serving only the first and second stories of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 are not required to be enclosed, provided at least two means of egress are provided from both floors served by the unenclosed stairways. Such inter-

connected stories shall not be open to other stories. Unenclosed exit stairways shall be remotely located as required in Section 1015.2.

1020.1.1 Openings and penetrations. Exit enclosure opening protectives shall be in accordance with the requirements of Section 715.

Except as permitted in Section 402.4.6, openings in exit enclosures other than unprotected exterior openings shall be limited to those necessary for exit access to the enclosure from normally occupied spaces and for egress from the enclosure.

Where interior exit enclosures are extended to the exterior of a building by an exit passageway, the door assembly from the exit enclosure to the exit passageway shall be protected by a fire door assembly conforming to the requirements in Section 715.4. Fire door assemblies in exit enclosures shall comply with Section 715.4.4.

Elevators shall not open into an exit enclosure.

1020.1.2 Penetrations. Penetrations into and openings through an exit enclosure are prohibited except for required exit doors, equipment and ductwork necessary for independent pressurization, sprinkler piping, standpipes, electrical raceway for fire department communication systems and electrical raceway serving the exit enclosure and terminating at a steel box not exceeding 16 square inches (0.010 m^2). Such penetrations shall be protected in accordance with Section 712. There shall be no penetrations or communication openings, whether protected or not, between adjacent exit enclosures.

1020.1.3 Ventilation. Equipment and ductwork for exit enclosure ventilation as permitted by Section 1020.1.2 shall comply with one of the following items:

1. Such equipment and ductwork shall be located exterior to the building and shall be directly connected to the exit enclosure by ductwork enclosed in construction as required for shafts.
2. Where such equipment and ductwork is located within the exit enclosure, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required for shafts.
3. Where located within the building, such equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for shafts.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by opening protectives in accordance with Section 715 for shaft enclosures.

Exit enclosure ventilation systems shall be independent of other building ventilation systems.

1020.1.4 Exit enclosure exterior walls. Exterior walls of an exit enclosure shall comply with the requirements of Section 704 for exterior walls. Where nonrated walls or unprotected openings enclose the exterior of the stairway and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building exterior walls within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a fire-resistance rating of not less than 1 hour. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $^3/_4$ hour. This construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the topmost landing of the stairway or to the roof line, whichever is lower.

1020.1.5 Discharge identification barrier. A stairway in an exit enclosure shall not continue below the level of exit discharge unless an approved barrier is provided at the level of exit discharge to prevent persons from unintentionally continuing into levels below. Directional exit signs shall be provided as specified in Section 1011.

1020.1.6 Stairway floor number signs. A sign shall be provided at each floor landing in interior exit enclosures connecting more than three stories designating the floor level, the terminus of the top and bottom of the stair enclosure and the identification of the stair. The signage shall also state the story of, and the direction to the exit discharge and the availability of roof access from the stairway for the fire department. The sign shall be located 5 feet (1524 mm) above the floor landing in a position that is readily visible when the doors are in the open and closed positions.

1020.1.7 Smokeproof enclosures. In buildings required to comply with Section 403 or 405, each of the exits of a building that serves stories where the floor surface is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access or more than 30 feet (9144 mm) below the level of exit discharge serving such floor levels shall be a smokeproof enclosure or pressurized stairway in accordance with Section 909.20.

1020.1.7.1 Enclosure exit. A smokeproof enclosure or pressurized stairway shall exit into a public way or into an exit passageway, yard or open space having direct access to a public way. The exit passageway shall be without other openings and shall be separated from the remainder of the building by 2-hour fire-resistance-rated construction.

Exceptions:

1. Openings in the exit passageway serving a smokeproof enclosure are permitted where the exit passageway is protected and pressurized in the same manner as the smokeproof enclosure, and openings are protected as required for access from other floors.
2. Openings in the exit passageway serving a pressurized stairway are permitted where the exit passageway is protected and pressurized in the same manner as the pressurized stairway.
3. A smokeproof enclosure or pressurized stairway shall be permitted to egress through areas on the level of discharge or vestibules as permitted by Section 1024.

1020.1.7.2 Enclosure access. Access to the stairway within a smokeproof enclosure shall be by way of a vestibule or an open exterior balcony.

Exception: Access is not required by way of a vestibule or exterior balcony for stairways using the pressurization alternative complying with Section 909.20.5.

SECTION 1021
EXIT PASSAGEWAYS

1021.1 Exit passageway. Exit passageways serving as an exit component in a means of egress system shall comply with the requirements of this section. An exit passageway shall not be used for any purpose other than as a means of egress.

1021.2 Width. The width of exit passageways shall be determined as specified in Section 1005.1 but such width shall not be less than 44 inches (1118 mm), except that exit passageways serving an occupant load of less than 50 shall not be less than 36 inches (914 mm) in width.

The required width of exit passageways shall be unobstructed.

Exception: Doors, when fully opened, and handrails, shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one-half. Other nonstructural projections such as trim and similar decorative features are permitted to project into the required width 1.5 inches (38 mm) on each side.

1021.3 Construction. Exit passageway enclosures shall have walls, floors and ceilings of not less than 1-hour fire-resistance rating, and not less than that required for any connecting exit enclosure. Exit passageways shall be constructed as fire barriers in accordance with Section 706.

1021.4 Openings and penetrations. Exit passageway opening protectives shall be in accordance with the requirements of Section 715.

Except as permitted in Section 402.4.6, openings in exit passageways other than unexposed exterior openings shall be limited to those necessary for exit access to the exit passageway from normally occupied spaces and for egress from the exit passageway.

Where interior exit enclosures are extended to the exterior of a building by an exit passageway, the door assembly from the exit enclosure to the exit passageway shall be protected by a fire door conforming to the requirements in Section 715.4. Fire door assemblies in exit passageways shall comply with Section 715.4.4.

Elevators shall not open into an exit passageway.

1021.5 Penetrations. Penetrations into and openings through an exit passageway are prohibited except for required exit doors, equipment and ductwork necessary for independent pressurization, sprinkler piping, standpipes, electrical raceway for fire department communication and electrical raceway serving the exit passageway and terminating at a steel box not exceeding 16 square inches (0.010 m^2). Such penetrations shall be protected in accordance with Section 712. There shall be no penetrations or communicating openings, whether protected or not, between adjacent exit passageways.

SECTION 1022
HORIZONTAL EXITS

1022.1 Horizontal exits. Horizontal exits serving as an exit in a means of egress system shall comply with the requirements of this section. A horizontal exit shall not serve as the only exit from a portion of a building, and where two or more exits are required, not more than one-half of the total number of exits or total exit width shall be horizontal exits.

Exceptions:

1. Horizontal exits are permitted to comprise two-thirds of the required exits from any building or floor area for occupancies in Group I-2.
2. Horizontal exits are permitted to comprise 100 percent of the exits required for occupancies in Group I-3. At least 6 square feet (0.6 m^2) of accessible space per occupant shall be provided on each side of the horizontal exit for the total number of people in adjoining compartments.

Every fire compartment for which credit is allowed in connection with a horizontal exit shall not be required to have a stairway or door leading directly outside, provided the adjoining fire compartments have stairways or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.

The area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of this chapter, but not including the added occupant capacity imposed by persons entering it through horizontal exits from another area. At least one of its exits shall lead directly to the exterior or to an exit enclosure.

1022.2 Separation. The separation between buildings or refuge areas connected by a horizontal exit shall be provided by a fire wall complying with Section 705 or a fire barrier complying with Section 706 and having a fire-resistance rating of not less than 2 hours. Opening protectives in horizontal exit walls shall also comply with Section 715. The horizontal exit separation shall extend vertically through all levels of the building unless floor assemblies have a fire-resistence rating of not less than 2 hours with no unprotected openings.

Exception: A fire-resistance rating is not required at horizontal exits between a building area and an above-grade pedestrian walkway constructed in accordance with Section 3104, provided that the distance between connected buildings is more than 20 feet (6096 mm).

Horizontal exit walls constructed as fire barriers shall be continuous from exterior wall to exterior wall so as to divide completely the floor served by the horizontal exit.

1022.3 Opening protectives. Fire doors in horizontal exits shall be self-closing or automatic-closing when activated by a smoke detector in accordance with Section 715.4.7.3. Doors, where located in a cross-corridor condition, shall be auto-

matic-closing by activation of a smoke detector installed in accordance with Section 715.4.7.3.

1022.4 Capacity of refuge area. The refuge area of a horizontal exit shall be a space occupied by the same tenant or a public area and each such refuge area shall be adequate to accommodate the original occupant load of the refuge area plus the occupant load anticipated from the adjoining compartment. The anticipated occupant load from the adjoining compartment shall be based on the capacity of the horizontal exit doors entering the refuge area. The capacity of the refuge area shall be computed based on a net floor area allowance of 3 square feet (0.2787 m^2) for each occupant to be accommodated therein.

Exception: The net floor area allowable per occupant shall be as follows for the indicated occupancies:

1. Six square feet (0.6 m^2) per occupant for occupancies in Group I-3.
2. Fifteen square feet (1.4 m^2) per occupant for ambulatory occupancies in Group I-2.
3. Thirty square feet (2.8 m^2) per occupant for nonambulatory occupancies in Group I-2.

SECTION 1023
EXTERIOR EXIT RAMPS AND STAIRWAYS

1023.1 Exterior exit ramps and stairways. Exterior exit ramps and stairways serving as an element of a required means of egress shall comply with this section.

Exception: Exterior exit ramps and stairways for outdoor stadiums complying with Section 1020.1, Exception 2.

1023.2 Use in a means of egress. Exterior exit ramps and stairways shall not be used as an element of a required means of egress for Group I-2 occupancies. For occupancies in other than Group I-2, exterior exit ramps and stairways shall be permitted as an element of a required means of egress for buildings not exceeding four stories above grade plane or having occupied floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

1023.3 Open side. Exterior exit ramps and stairways serving as an element of a required means of egress shall be not less than 50 percent open on one side. Outside stairs shall be arranged to restrict the accumulation of smoke.

1023.4 Side yards. The open areas adjoining exterior exit ramps or stairways shall be either yards, courts or public ways; the remaining sides are permitted to be enclosed by the exterior walls of the building.

1023.5 Location. Exterior exit ramps and stairways shall be located in accordance with Section 1024.3.

1023.6 Exterior ramps and stairway protection. Exterior exit ramps and stairways shall be separated from the interior of the building as required in Section 1020.1. Openings shall be limited to those necessary for egress from normally occupied spaces.

Exceptions:

1. Separation from the interior of the building is not required for occupancies, other than those in Group R-1 or R-2, in buildings that are no more than two stories above grade plane where the level of exit discharge is the first story above grade plane.
2. Separation from the interior of the building is not required where the exterior ramp or stairway is served by an exterior ramp and/or balcony that connects two remote exterior stairways or other approved exits with a perimeter that is not less than 50 percent open. To be considered open, the opening shall be a minimum of 50 percent of the height of the enclosing wall, with the top of the openings no less than 7 feet (2134 mm) above the top of the balcony.
3. Separation from the interior of the building is not required for an exterior ramp or stairway located in a building or structure that is permitted to have unenclosed interior stairways in accordance with Section 1020.1.
4. Separation from the interior of the building is not required for exterior ramps or stairways connected to open-ended corridors, provided that Items 4.1 through 4.4 are met:
   - 4.1. The building, including corridors and ramps and/or stairs, shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
   - 4.2. The open-ended corridors comply with Section 1017.
   - 4.3. The open-ended corridors are connected on each end to an exterior exit ramp or stairway complying with Section 1023.
   - 4.4. At any location in an open-ended corridor where a change of direction exceeding 45 degrees (0.79 rad) occurs, a clear opening of not less than 35 square feet (3.3 m^2) or an exterior ramp or stairway shall be provided. Where clear openings are provided, they shall be located so as to minimize the accumulation of smoke or toxic gases.

SECTION 1024
EXIT DISCHARGE

1024.1 General. Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide direct access to grade. The exit discharge shall not reenter a building.

Exceptions:

1. A maximum of 50 percent of the number and capacity of the exit enclosures is permitted to egress through areas on the level of discharge provided all of the following are met:
   - 1.1. Such exit enclosures egress to a free and unobstructed way to the exterior of the building, which way is readily visible and identifiable from the point of termination of the exit enclosure.

1.2. The entire area of the level of discharge is separated from areas below by construction conforming to the fire-resistance rating for the exit enclosure.

1.3. The egress path from the exit enclosure on the level of discharge is protected throughout by an approved automatic sprinkler system. All portions of the level of discharge with access to the egress path shall either be protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, or separated from the egress path in accordance with the requirements for the enclosure of exits.

2. A maximum of 50 percent of the number and capacity of the exit enclosures is permitted to egress through a vestibule provided all of the following are met:

2.1. The entire area of the vestibule is separated from areas below by construction conforming to the fire-resistance rating for the exit enclosure.

2.2. The depth from the exterior of the building is not greater than 10 feet (3048 mm) and the length is not greater than 30 feet (9144 mm).

2.3. The area is separated from the remainder of the level of exit discharge by construction providing protection at least the equivalent of approved wired glass in steel frames.

2.4. The area is used only for means of egress and exits directly to the outside.

3. Stairways in open parking garages complying with Section 1020.1, Exception 5, are permitted to egress through the open parking garage at the level of exit discharge.

1024.2 Exit discharge capacity. The capacity of the exit discharge shall be not less than the required discharge capacity of the exits being served.

1024.3 Exit discharge location. Exterior balconies, stairways and ramps shall be located at least 10 feet (3048 mm) from adjacent lot lines and from other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 704 based on fire separation distance.

1024.4 Exit discharge components. Exit discharge components shall be sufficiently open to the exterior so as to minimize the accumulation of smoke and toxic gases.

1024.5 Egress courts. Egress courts serving as a portion of the exit discharge in the means of egress system shall comply with the requirements of Section 1024.

1024.5.1 Width. The width of egress courts shall be determined as specified in Section 1005.1, but such width shall not be less than 44 inches (1118 mm), except as specified herein. Egress courts serving Group R-3 and U occupancies shall not be less than 36 inches (914 mm) in width.

The required width of egress courts shall be unobstructed to a height of 7 feet (2134 mm).

Exception: Doors, when fully opened, and handrails shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one-half. Other nonstructural projections such as trim and similar decorative features are permitted to project into the required width 1.5 inches (38 mm) from each side.

Where an egress court exceeds the minimum required width and the width of such egress court is then reduced along the path of exit travel, the reduction in width shall be gradual. The transition in width shall be affected by a guard not less than 36 inches (914 mm) in height and shall not create an angle of more than 30 degrees (0.52 rad) with respect to the axis of the egress court along the path of egress travel. In no case shall the width of the egress court be less than the required minimum.

1024.5.2 Construction and openings. Where an egress court serving a building or portion thereof is less than 10 feet (3048 mm) in width, the egress court walls shall have not less than 1-hour fire-resistance-rated construction for a distance of 10 feet (3048 mm) above the floor of the court. Openings within such walls shall be protected by opening protectives having a fire protection rating of not less than $^3/_4$ hour.

Exceptions:

1. Egress courts serving an occupant load of less than 10.
2. Egress courts serving Group R-3.

1024.6 Access to a public way. The exit discharge shall provide a direct and unobstructed access to a public way.

Exception: Where access to a public way cannot be provided, a safe dispersal area shall be provided where all of the following are met:

1. The area shall be of a size to accommodate at least 5 square feet (0.28 m^2) for each person.
2. The area shall be located on the same lot at least 50 feet (15 240 mm) away from the building requiring egress.
3. The area shall be permanently maintained and identified as a safe dispersal area.
4. The area shall be provided with a safe and unobstructed path of travel from the building.

SECTION 1025
ASSEMBLY

1025.1 General. Occupancies in Group A which contain seats, tables, displays, equipment or other material shall comply with this section.

1025.1.1 Bleachers. Reserved.

1025.2 Assembly main exit. Every assembly occupancy shall be provided with a main entrance/exit. The minimum aggregate width of the main entrance for Group A occupancies shall

be sufficient to accommodate 50 percent of the occupant load and shall be at the level of exit discharge or shall connect to a stairway or ramp leading to a street. Each level of a Group A occupancy shall have access to a main exit and such access shall have sufficient capacity to accommodate 50 percent of the occupant load of such levels. Where the main exit from an assembly occupancy is through a lobby or foyer, the aggregate capacity of all exits from the lobby or foyer shall be permitted to provide the required capacity of the main exit regardless of whether all such exits serve as entrances to the building.

Exceptions:

1. A bowling establishment shall have a main entrance capable of accommodating 50 percent of the total occupant load regardless of the aisles that the entrance serves.
2. In assembly occupancies where there is no well-defined entrance/exit, exits may be distributed around the perimeter of the building, provided the total exit width furnishes a minimum of 100 percent of the width needed to accommodate the maximum occupant content.

1025.3 Assembly other exits. Each level of an assembly occupancy shall have access to a main exit and shall be provided with additional exits of sufficient width to accommodate one-half of the total occupant load served by that level. Such additional exits shall be located as far from the main entrance/exit as practicable. Such exits shall be accessible from a cross aisle or a side aisle.

Exception: In assembly occupancies where there is no well-defined entrance/exit, exits may be distributed around the perimeter of the building, provided the total exit width furnishes a minimum of 100 percent of the width needed to accommodate the maximum occupant content.

1025.4 Foyers and lobbies. In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available and are allowed to wait in a lobby or similar space, such use of lobby or similar space shall not encroach upon the required clear width of the means of egress. Such waiting areas shall be separated from the required means of egress by substantial permanent partitions or by fixed rigid railings not less than 42 inches (1067 mm) high. Such foyer, if not directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or path of travel to every such main entrance or exit.

1025.5 Interior balcony and gallery means of egress. For balconies or galleries having a seating capacity of 50 or more located in Group A occupancies, at least two means of egress shall be provided, with one from each side of every balcony or gallery and at least one leading directly to an exit.

1025.5.1 Enclosure of balcony openings. Interior stairways and other vertical openings shall be enclosed in an exit enclosure as provided in Section 1020.1, except that stairways are permitted to be open between the balcony and the main assembly floor in occupancies such as theaters, places of religious worship and auditoriums. At least one accessible means of egress is required from a balcony or gallery level containing accessible seating locations in accordance with Section 1007.3 or 1007.4.

1025.6 Width of means of egress for assembly. The clear width of aisles and other means of egress shall comply with Section 1025.6.1 where smoke-protected seating is not provided and with Section 1025.6.2 or 1025.6.3 where smoke-protected seating is provided. The clear width shall be measured to walls, edges of seating and tread edges except for permitted projections.

1025.6.1 Without smoke protection. The clear width of the means of egress shall provide sufficient capacity in accordance with all of the following, as applicable:

1. At least 0.3 inch (7.6 mm) of width for each occupant served shall be provided on stairs having riser heights 7 inches (178 mm) or less and tread depths 11 inches (279 mm) or greater, measured horizontally between tread nosings.
2. At least 0.005 inch (0.127 mm) of additional stair width for each occupant shall be provided for each 0.10 inch (2.5 mm) of riser height above 7 inches (178 mm).
3. Where egress requires stair descent, at least 0.075 inch (1.9 mm) of additional width for each occupant shall be provided on those portions of stair width having no handrail within a horizontal distance of 30 inches (762 mm).
4. Ramped means of egress, where slopes are steeper than one unit vertical in 12 units horizontal (8.333-percent slope), shall have at least 0.22 inch (5.6 mm) of clear width for each occupant served. Level or ramped means of egress, where slopes are not steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have at least 0.20 inch (5.1 mm) of clear width for each occupant served.

1025.6.2 Smoke-protected seating. The clear width of the means of egress for smoke-protected assembly seating shall not be less than the occupant load served by the egress element multiplied by the appropriate factor in Table 1025.6.2. The total number of seats specified shall be those within the space exposed to the same smoke-protected environment. Interpolation is permitted between the specific values shown. A life safety evaluation, complying with NFPA 101 as adopted by *Florida Fire Prevention Code*, shall be done for a facility utilizing the reduced width requirements of Table 1025.6.2 for smoke-protected assembly seating.

Exception: For an outdoor smoke-protected assembly with an occupant load not greater than 18,000, the clear width shall be determined using the factors in Section 1025.6.3.

1025.6.2.1 Smoke control. Means of egress serving a smoke-protected assembly seating area shall be provided with a smoke control system complying with Section 909 or natural ventilation designed to maintain the smoke level at least 6 feet (1829 mm) above the floor of the means of egress.

1025.6.2.2 Roof height. A smoke-protected assembly seating area with a roof shall have the lowest portion of

TABLE 1025.6.2
WIDTH OF AISLES FOR SMOKE-PROTECTED ASSEMBLY

TOTAL NUMBER OF SEATS IN THE SMOKE-PROTECTED ASSEMBLY OCCUPANCY	INCHES OF CLEAR WIDTH PER SEAT SERVED			
	Stairs and aisle steps with handrails within 30 inches	Stairs and aisle steps without handrails within 30 inches	Passageways, doorways and ramps not steeper than 1 in 10 in slope	Ramps steeper than 1 in 10 in slope
Equal to or less than 5,000	0.200	0.250	0.150	0.165
10,000	0.130	0.163	0.100	0.110
15,000	0.096	0.120	0.070	0.077
20,000	0.076	0.095	0.056	0.062
Equal to or greater than 25,000	0.060	0.075	0.044	0.048

For SI: 1 inch = 25.4 mm.

the roof deck not less than 15 feet (4572 mm) above the highest aisle or aisle accessway.

Exception: A roof canopy in an outdoor stadium shall be permitted to be less than 15 feet (4572 mm) above the highest aisle or aisle accessway provided that there are no objects less than 80 inches (2032 mm) above the highest aisle or aisle accessway.

1025.6.2.3 Automatic sprinklers. Enclosed areas with walls and ceilings in buildings or structures containing smoke-protected assembly seating shall be protected with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

Exceptions:

1. The floor area used for contests, performances or entertainment provided the roof construction is more than 50 feet (15 240 mm) above the floor level and the use is restricted to low fire hazard uses.
2. Press boxes and storage facilities less than 1,000 square feet (93 m^2) in area.
3. Outdoor seating facilities where seating and the means of egress in the seating area are essentially open to the outside.

1025.6.3 Width of means of egress for outdoor smoke-protected assembly. The clear width in inches (mm) of aisles and other means of egress shall be not less than the total occupant load served by the egress element multiplied by 0.08 (2.0 mm) where egress is by aisles and stairs and multiplied by 0.06 (1.52 mm) where egress is by ramps, corridors, tunnels or vomitories.

Exception: The clear width in inches (mm) of aisles and other means of egress shall be permitted to comply with Section 1025.6.2 for the number of seats in the outdoor smoke-protected assembly where Section 1025.6.2 permits less width.

1025.7 Travel distance. Exits and aisles shall be so located that the travel distance to an exit door shall not be greater than 200 feet measured along the line of travel in nonsprinklered buildings. Travel distance shall not be more than 250 feet in sprinklered buildings. Where aisles are provided for seating, the distance shall be measured along the aisles and aisle accessway without travel over or on the seats.

Exceptions:

1. Smoke-protected assembly seating: The travel distance from each seat to the nearest entrance to a vomitory or concourse shall not exceed 200 feet (60 960 mm). The travel distance from the entrance to the vomitory or concourse to a stair, ramp or walk on the exterior of the building shall not exceed 200 feet (60 960 mm).
2. Open-air seating: The travel distance from each seat to the building exterior shall not exceed 400 feet (122 m). The travel distance shall not be limited in facilities of Type I or II construction.
3. The travel distance within an exhibit booth or exhibit enclosure to an exit access aisle shall not be greater than 50 feet (15 240 mm).

1025.8 Common path of egress travel. A common path of travel shall be permitted for the 20 feet (6096 mm) from any point where serving any number of occupants and for the first 75 feet (22 860 mm) from any point where serving not more than 50 occupants.

Exception:

1. For smoke-protected assembly seating, the common path of travel shall not exceed 50 feet (1524 mm) from any seat to a point where a person has a choice of two directions of egress travel.

1025.8.1 Path through adjacent row. Where one of the two paths of travel is across the aisle through a row of seats to another aisle, there shall be not more than 24 seats between the two aisles, and the minimum clear width between rows for the row between the two aisles shall be 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row between aisles.

Exception: For smoke-protected assembly seating there shall not be more than 40 seats between the two aisles and the minimum clear width shall be 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat.

1025.9 Assembly aisles are required. Every occupied portion of any occupancy in Group A that contains seats, tables, dis-

plays, similar fixtures or equipment shall be provided with aisles leading to exits or exit access doorways in accordance with this section. Aisle accessways for tables and seating shall comply with Section 1014.4.3.

1025.9.1 Minimum aisle width. The minimum clear width for aisles serving seating not at tables shall be as shown:

1. Forty-eight inches (1219 mm) for aisle stairs having seating on each side.

   Exception: Thirty-six inches (914 mm) where the aisle serves less than 50 seats.

2. Thirty-six inches (914 mm) for aisle stairs having seating on only one side.
3. Twenty-three inches (584 mm) between an aisle stair handrail or guard and seating where the aisle is subdivided by a handrail.
4. Forty-two inches (1067 mm) for level or ramped aisles having seating on both sides.

   Exceptions:

   1. Thirty-six inches (914 mm) where the aisle serves less that 50 seats.
   2. Thirty inches (762 mm) where the aisle does not serve more than 14 seats.

5. Thirty-six inches (914 mm) for level or ramped aisles having seating on only one side.

Exceptions:

1. Thirty inches (762 mm) where the aisle does not serve more than 14 seats.
2. Twenty-three inches (584 mm) between an aisle stair handrail and seating where an aisle does not serve more than five rows on one side.

1025.9.1.1 The minimum width of aisles serving seating at tables shall be 44 inches (1118 mm).

Exception: Thirty-six inches (914 mm) where serving an occupant load of not more than 50.

1025.9.2 Means of egress capacity. The capacity of means of egress shall be in accordance with Section 1005. The width of aisles and other means of egress serving theater-type seating or similar seating arranged in rows shall provide sufficient capacity in accordance with Sections 1024.9.2.1 and 1024.9.2.2.

1025.9.2.1 Minimum clear widths of aisles and other means of egress serving theater-type seating, or similar seating arranged in rows, shall be in accordance with Table 1024.9.2.1.

TABLE 1025.9.2.1
CAPACITY FACTORS

NO. OF SEATS	NOMINAL FLOW TIME (sec)	INCH OF CLEAR WIDTH PER SEAT SERVED	
		STAIRS	PASSAGEWAYS, RAMPS, AND DOORWAYS
Unlimited	200	0.300 AB	0.220 C

1025.9.2.2 The minimum clear widths shown in Table 1025.9.2.1 shall be modified in accordance with all of the following:

1. If risers exceed 7 inches (178 mm) in height, multiply the stair width in the table by factor A, where

$$A = 1 + \frac{(\text{riser height} - 7 \text{ inches})}{5}$$

2. Stairs not having a handrail within a 30-inch (762 mm) horizontal distance shall be 25 percent wider than otherwise calculated (i.e., multiply by factor B = 1.25).
3. Ramps steeper than 1:10 slope where used in ascent shall have their width increased by 10 percent (i.e., multiply by factor C = 1.10).

   Exceptions:

   1. Lighting and access catwalks shall meet the requirements for Group F occupancies.
   2. Grandstands, bleachers and folding and telescopic seating as permitted by Section 1024.6.2.

1025.9.2.3 Clear width shall be measured to walls, edges of seating and tread edges except for permitted projections.

1025.9.4 Uniform width. Those portions of aisles, where egress is possible in either of two directions, shall be uniform in required width.

1025.9.5 Assembly aisle termination. Each end of an aisle shall terminate at cross aisle, foyer, doorway, vomitory or concourse having access to an exit.

Exceptions:

1. Dead-end aisles shall not be greater than 20 feet (6096 mm) in length.
2. Dead-end aisles longer than 20 feet (6096 mm) are permitted where seats beyond the 20-foot (6096 mm) dead-end aisle are no more than 24 seats from another aisle, measured along a row of seats having a minimum clear width of 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row.
3. For smoke-protected assembly seating, the dead-end aisle length of vertical aisles shall not exceed a distance of 21 rows.
4. For smoke-protected assembly seating, a longer dead-end aisle is permitted where seats beyond the 21-row dead-end aisle are not more than 40 seats from another aisle, measured along a row of seats having an aisle accessway with a minimum clear width of 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat above seven in the row.

1025.9.6 Assembly aisle obstructions. There shall be no obstructions in the required width of aisles except for handrails as provided in Section 1025.13.

1025.10 Aisle accessways. The aisle accessway between rows of seating shall have a clear width of not less than 12 inches (305 mm), and the minimum width shall be increased in accordance with Sections 1024.10.2 for seating not at tables and Section 1024.10.2.2 for seating at tables. The width of aisle accessways shall be the clear horizontal distance from the back of the row ahead and the nearest projection of the row behind. Where chairs have automatic or self-rising seats that comply with ASTM F 851, the measurement shall be made with seats in the raised position. Where any chair in the row does not have an automatic or self-rising seat, the measurements shall be made with the seat in the down position. For seats with folding tablet arms, row spacing shall be determined with the tablet in the useable position.

Exception: When not more than four persons are served, there shall be no minimum clear width requirement for the portion of the aisle accessway having a length not exceeding 6 feet (1829 mm) measured from the center of the seat farthest from the aisle.

1025.10.1 Dual access. Reserved.

1025.10.2 Single access. For rows of seating not at tables served by aisles or doorways at both ends there shall be no more than 100 seats per row and the 12 inches (305 mm) minimum clear width of aisle accessways shall be increased by 0.3 inch (7.6 mm) for every additional seat beyond 14, but the minimum clear width shall not be required to exceed 22 inches (559 mm).

Exception: For smoke-protected assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1025.10.2.

1025.10.2.1 For rows of seating not at tables served by an aisle or doorway at one end only, the 12 inches (305 mm) minimum clear width of aisle accessways shall be increased by 0.6 inch (15.2 mm) for every additional seat beyond seven, but the minimum clear width shall not be required to exceed 22 inches (559 mm).

Exception: For smoke-protected assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1025.10.2.

TABLE 1025.10.2
SMOKE-PROTECTED ASSEMBLY AISLE ACCESSWAYS

TOTAL NUMBER OF SEATS IN THE SMOKE-PROTECTED ASSEMBLY OCCUPANCY	MAXIMUM NUMBER OF SEATS PER ROW PERMITTED TO HAVE A MINIMUM 12-INCH CLEAR WIDTH AISLE ACCESSWAY	
	Aisle or doorway at both ends of row	Aisle or doorway at one end of row only
Less than 4,000	14	7
4,000	15	7
7,000	16	8
10,000	17	8
13,000	18	9
16,000	19	9
19,000	20	10
22,000 and greater	21	11

For SI: 1 inch = 25.4 mm.

1025.10.2.1.2 For rows of seating not at tables served by an aisle or doorway on one end only, the path of travel shall not exceed 30 feet (9144 mm) from any seat to a point where a person has a choice of two paths of travel to two exits.

1025.10.2.2 Aisle accessways serving seating at tables shall have a minimum clear width of 12 inches (305 mm).

1025.10.2.2.1 Where nonfixed seating is located between a table and an aisle accessway, the measurement of required clear width of the aisle accessway shall be made to a line 19 inches (483 mm) away from the edge of the table. The 19-inch (483 mm) distance shall be measured perpendicularly to the edge of the table.

1025.10.2.2.2 The minimum 12-inch (305 mm) width required for an aisle accessway shall be increased by 0.5 inch (13 mm) for each additional 12 inches (305 mm) or fraction thereof beyond 12 feet (3658 mm) of aisle accessway length where measured from the center of the seat farthest from an aisle.

1025.10.2.2.3 The path of travel along the aisle accessway shall not exceed 36 feet (10 973 mm) from any seat to the closest aisle or egress doorway.

1025.11 Assembly aisle walking surfaces. Aisles with a slope not exceeding one unit vertical in eight units horizontal (12.5-percent slope) shall consist of a ramp having a slip-resistant walking surface. Aisles with a slope exceeding one unit vertical in eight units horizontal (12.5-percent slope) shall consist of a series of risers and treads that extends across the full width of aisles and complies with Sections 1025.11.1 through 1025.11.3.

1025.11.1 Treads. Tread depths shall be a minimum of 11 inches (279 mm) and shall have dimensional uniformity.

Exception: The tolerance between adjacent treads shall not exceed 0.188 inch (4.8 mm).

1025.11.2 Risers. Where the gradient of aisle stairs is to be the same as the gradient of adjoining seating areas, the riser height shall not be less than 4 inches (102 mm) nor more

than 8 inches (203 mm) and shall be uniform within each flight.

Exceptions:

1. The riser height of aisle stairs in folding and telescopic seating shall be permitted to be not less than $3^1/_2$ inches (89 mm) and shall not exceed 11 inches (279 mm).
2. Riser heights not exceeding 9 inches (229 mm) shall be permitted where they are necessitated by the slope of the adjacent seating areas to maintain sightlines.

1025.11.3 Tread contrasting marking stripe. A contrasting marking stripe shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be a minimum of 1 inch (25 mm), and a maximum of 2 inches (51 mm), wide.

Exception: The contrasting marking stripe is permitted to be omitted where tread surfaces are such that the location of each tread is readily apparent when viewed in descent.

1025.12 Seat stability. In places of assembly, the seats shall be securely fastened to the floor.

Exceptions:

1. In places of assembly or portions thereof without ramped or tiered floors for seating and with 200 or fewer seats, the seats shall not be required to be fastened to the floor.
2. In places of assembly or portions thereof with seating at tables and without ramped or tiered floors for seating, the seats shall not be required to be fastened to the floor.
3. In places of assembly or portions thereof without ramped or tiered floors for seating and with greater than 200 seats, the seats shall be fastened together in groups of not less than three or the seats shall be securely fastened to the floor.
4. In places of assembly where flexibility of the seating arrangement is an integral part of the design and function of the space and seating is on tiered levels, a maximum of 200 seats shall not be required to be fastened to the floor. Plans showing seating, tiers and aisles shall be submitted for approval.
5. Groups of seats within a place of assembly separated from other seating by railings, guards, partial height walls or similar barriers with level floors and having no more than 14 seats per group shall not be required to be fastened to the floor.
6. Seats intended for musicians or other performers and separated by railings, guards, partial height walls or similar barriers shall not be required to be fastened to the floor.
7. Restaurants, cafeterias, cafetoriums, gymnasiums, gymnatoriums and similar multipurpose assembly occupancies.
8. Movable seating in rows with seats fastened together in groups of not less than three nor more than seven.
9. Seats in balconies, galleries, railed in enclosures, boxes or loges with level floor surfaces and having occupant loads not exceeding 14.
10. Assembly occupancies in accordance with Exception 1 or 3 shall not have more than one seat for 15 square feet (1.4 m^2) of net floor area and shall provide adequate aisles to reach exits.

1025.13 Handrails. Ramped aisles having a slope exceeding one unit vertical in 15 units horizontal (6.7-percent slope) and aisle stairs shall be provided with handrails located either at the side or within the aisle width. Handrails shall not be required where otherwise permitted by the following:

1. Handrails shall not be required for ramped aisles having a gradient not steeper than 1:8 and having seating on both sides where the aisle does not serve as an accessible route.
2. The requirement for a handrail shall be satisfied by the use of a guard provided with a rail that complies with the graspability requirements for handrails and located at a consistent height between 34 inches and 42 inches (865 mm and 1065 mm), measured using one of the following methods:
   2.1. Vertically from the top of the rail to the leading edge (nosing) of stair treads.
   2.2. Vertically from the top of the rail to the adjacent walking surface in the case of a ramp.

1025.13.1 Discontinuous handrails. Where there is seating on both sides of the aisle, the handrails shall be discontinuous with gaps or breaks at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the aisle to the other. These gaps or breaks shall have a clear width of at least 22 inches (559 mm) and not greater than 36 inches (914 mm), measured horizontally, and the handrail shall have rounded terminations or bends.

1025.13.2 Intermediate handrails. Where handrails are provided in the middle of aisle stairs, there shall be an additional intermediate handrail located approximately 12 inches (305 mm) below the main handrail.

1025.14 Assembly guards. Assembly guards shall comply with Sections 1025.14.1 through 1025.14.3.

1025.14.1 Cross aisles. Cross aisles located more than 30 inches (762 mm) above the floor or grade below shall have guards in accordance with Section 1013.

Where an elevation change of 30 inches (762 mm) or less occurs between a cross aisle and the adjacent floor or grade below, guards not less than 26 inches (660 mm) above the aisle floor shall be provided.

Exception: Where the backs of seats on the front of the cross aisle project 24 inches (610 mm) or more above the adjacent floor of the aisle, a guard need not be provided.

1025.14.2 Sightline-constrained guard heights. Unless subject to the requirements of Section 1025.14.3, a fascia or railing system in accordance with the guard requirements of

Section 1013 and having a minimum height of 26 inches (660 mm) shall be provided where the floor or footboard elevation is more than 30 inches (762 mm) above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of immediately adjacent seating. At bleachers, a guard must be provided where the floor or footboard elevation is more than 24 inches (610 mm) above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of the immediately adjacent seating.

1025.14.3 Guards at the end of aisles. A fascia or railing system complying with the guard requirements of Section 1013 shall be provided for the full width of the aisle where the foot of the aisle is more than 30 inches (762 mm) above the floor or grade below. The fascia or railing shall be a minimum of 36 inches (914 mm) high and shall provide a minimum 42 inches (1067 mm) measured diagonally between the top of the rail and the nosing of the nearest tread.

1025.15 Bench seating. Where bench seating is used, the number of persons shall be based on one person for each 18 inches (457 mm) of length of the bench.

SECTION 1026
EMERGENCY ESCAPE AND RESCUE

1026.1 General. In addition to the means of egress required by this chapter, provisions shall be made for emergency escape and rescue in Group R and I-1 occupancies. Basements and sleeping rooms below the fourth story above grade plane shall have at least one exterior emergency escape and rescue opening in accordance with this section. Where basements contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Such openings shall open directly into a public way or to a yard or court that opens to a public way. The emergency escape and rescue opening shall be permitted to open into a screen enclosure, open to the atmosphere, where a screen door is provided leading away from the residence. Such opening shall be operational from the inside without the use of special knowledge, keys or tools.

Exceptions:

1. In other than Group R-3 occupancies, buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. In other than Group R-3 occupancies, sleeping rooms provided with a door to a fire-resistance-rated corridor having access to two remote exits in opposite directions.
3. The emergency escape and rescue opening is permitted to open onto a balcony within an atrium in accordance with the requirements of Section 404, provided the balcony provides access to an exit and the dwelling unit or sleeping unit has a means of egress that is not open to the atrium.
4. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue windows.
5. High-rise buildings in accordance with Section 403.
6. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, court or exterior exit balcony that opens to a public way.
7. Basements without habitable spaces and having no more than 200 square feet (18.6m2) in floor area shall not be required to have emergency escape windows.
8. Security and hurricane devices installed in accordance with Section 1008.1.3.6.

1026.2 Minimum size. Emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.53 m^2).

Exception: The minimum net clear opening for emergency escape and rescue grade-floor openings shall be 5 square feet (0.46 m^2).

1026.2.1 Minimum dimensions. The minimum net clear opening height dimension shall be 24 inches (610 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

1026.3 Maximum height from floor. Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches (1118 mm) measured from the floor.

1026.4 Operational constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools. Bars, grilles, grates or similar devices are permitted to be placed over emergency escape and rescue openings provided the minimum net clear opening size complies with Section 1026.2 and such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening. See Section 1008.1.3.6 for provisions related to hurricane protection devices. Where such bars, grilles, grates or similar devices are installed in existing buildings, smoke alarms shall be installed in accordance with Section 907.2.10 regardless of the valuation of the alteration.

1026.4.1 Every room or space greater than 250 square feet (23.2 m^2) in educational occupancies used for classroom or other educational purposes or normally subject to student occupancy and every room or space normally subject to client occupancy, other than bathrooms, in Group D occupancies shall have not less than one outside window for emergency rescue that complies with the following:

1. Such windows shall be openable from the inside without the use of tools and shall provide a clear opening of not less than 20 inches (508 mm) in width, 24 inches (610 mm) in height, and 5.7 square feet (0.53 m^2) in area.
2. The bottom of the opening shall be not more than 44 inches (1118 mm) above the floor, and any latching

device shall be capable of being operated from not more than 54 inches (1372 mm) above the finished floor.

1026.5 Window wells. An emergency escape and rescue opening with a finished sill height below the adjacent ground level shall be provided with a window well in accordance with Sections 1026.5.1 and 1026.5.2.

1026.5.1 Minimum size. The minimum horizontal area of the window well shall be 9 square feet (0.84 m^2), with a minimum dimension of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

1026.5.2 Ladders or steps. Window wells with a vertical depth of more than 44 inches (1118 mm) shall be equipped with an approved permanently affixed ladder or steps. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center (o.c.) vertically for the full height of the window well. The ladder or steps shall not encroach into the required dimensions of the window well by more than 6 inches (152 mm). The ladder or steps shall not be obstructed by the emergency escape and rescue opening. Ladders or steps required by this section are exempt from the stairway requirements of Section 1009.

SECTION 1027
BUSINESS

1027.1 Doors. Egress doors shall conform to the requirements of Section 1008, except doors serving office areas with an occupant load of 10 or less need not be side-swinging type.

1027.2 Handrails and guardrails. Handrails and guardrails shall be in accordance with Sections 1009.11 and 1012.

Exception: In areas not accessible to the public and in fully enclosed stairways in office buildings not serving a Group A, E or R occupancy, the clear distance between rails or ornamental pattern shall be such as to prevent the passage of a 21-inch (533 mm) diameter sphere.

1027.3 Stairs. Spiral stairs complying with Section 1009.9 shall be permitted as a component in a means of egress.

1027.4 Common path of travel. In Group B buildings which are sprinklered throughout, a common path of travel not exceeding 100 feet (30 480 mm) shall be permitted.

SECTION 1028
EDUCATIONAL

1028.1 Exterior corridors or balconies.

1028.1.1 A corridor roofed over and enclosed on its long sides and open to the atmosphere at the ends may be considered an exterior corridor provided:

1. Clear story openings not less than one-half the height of the corridor walls are provided on both sides of the corridor and above adjacent roofs or buildings, or
2. The corridor roof has unobstructed openings to the sky with the open area not less than 50 percent of the area of the roof. Openings shall be equally distributed with any louvers fixed open. The clear area of openings with fixed louvers shall be based on the actual openings between louver vanes.

1028.1.2 The minimum width of such corridors shall be sufficient to accommodate the occupant load but shall in no case be less than 6 feet (1829 mm).

1028.2 Panic and fire exit hardware.

1028.2.1 Each door in a means of egress from an area of Group E occupancy having an occupant load of 100 or more may be provided with a latch or lock only if it is panic hardware or fire exit hardware, which releases when a force of no more than 15 pounds (67 N) is applied to the releasing devices in the direction of exit travel. Such releasing devices may be bars or panels extending not less than one-half the width of the door and placed at heights suitable for the service required, but not less than 34 inches (864 mm) nor more than 48 inches (1219 mm) above the floor. Whenever panic hardware is used on a labeled fire door, the panic hardware shall be labeled as fire exit hardware.

1028.2.2 If balanced doors are used and panic hardware is required, the panic hardware shall be of the pushpad type and the pad shall not extend more than one-half the width of the door measured from the latch side.

1028.3 Doors that swing into an exit access corridor shall be recessed to prevent interference with corridor traffic; any doors not recessed shall open 180 degrees (3.1 rad) to stop against the wall. Doors in any position shall not reduce the required corridor width by more than one-half.

SECTION 1029
FACTORY-INDUSTRIAL

1029.1 Handrails and guardrails. Handrails and guardrails shall be installed in accordance with Sections 1009.11 and 1012.

Exception: In areas not accessible to the public in Group F, the clear distance between rails or ornamental pattern shall be such as to prevent the passage of a 21-inch (533 mm) diameter sphere.

1029.2 Stairs. Spiral stairs complying with Section 1009.9 shall be permitted as a component in a means of egress.

1029.3 Common path of travel. Common paths of travel in Group F, special purpose occupancies shall not exceed 50 feet (15 240 mm).

Exception: In Group F buildings, which are sprinklered throughout, a common path of travel not exceeding 100 feet (30 486 mm) shall be permitted.

SECTION 1030
INSTITUTIONAL

1030.1 Locks. Patient rooms or tenant space egress doors in Group I occupancies shall not be lockable.

Exceptions:

1. In places of restraint or detention.
2. Door locking arrangements without delayed egress shall be permitted in Groups I-1 and I-2, or portions of such occupancies, where the clinical needs of the patients require specialized security measures for their safety, provided that staff can readily unlock such doors at all times.
3. Key locking devices that restrict access from the corridor and that are operable only by staff from the corridor side shall be permitted. Such devices shall not restrict egress from the room.

1030.2 Arrangement of means of egress.

1030.2.1 Every habitable room shall have an exit access door leading directly to an exit access corridor.

Exceptions:

1. If there is an exit door opening directly to the outside from the room at ground level.
2. Patient sleeping rooms shall be permitted to have one intervening room if the intervening room is not used as an exit access for more than eight patient sleeping beds.
3. Special nursing suites shall be permitted to have one intervening room where the arrangement allows for direct and constant visual supervision by nursing personnel.
4. For rooms other than patient sleeping rooms, one or more adjacent rooms shall be permitted to intervene in accordance with Section 1030.8.

1030.3 Any patient sleeping room, or any suite that includes patient sleeping rooms, of more than 1,000 square feet (93 m^2) shall have at least two exit access doors remotely located from each other.

1030.4 Any room or any suite of rooms, other than patient sleeping rooms, of more than 2,500 square feet (230 m^2) shall have at least two exit access doors remotely located from each other.

1030.5 Any suite of rooms that complies with the requirements of Section 1030.3 shall be permitted to be subdivided with nonfire-rated, noncombustible or limited-combustible partitions.

1030.6 Suites of sleeping rooms shall not exceed 5,000 square feet (460 m^2).

1030.7 Suites of rooms, other than patient sleeping rooms, shall not exceed 10,000 square feet (930 m^2).

1030.8 Suites of rooms, other than patient sleeping rooms, shall be permitted to have one intervening room if the travel distance within the suite to the exit access door is not greater than 100 feet (30 480 mm) and shall be permitted to have two intervening rooms where the travel distance within the suite to the exit access door is not greater than 50 feet (15 240 mm).

1030.9 Every corridor shall provide access to at least two approved exits without passing through any intervening rooms or spaces other than corridors or lobbies.

1030.10 Every exit or exit access shall be arranged so that no corridor, aisle or passageway has a pocket or dead end exceeding 20 feet (6096 mm).

1030.11 Travel distance.

1030.11.1 Travel distance shall not exceed that specified in Table 1015.1.

1030.11.2 Travel distance shall comply with Section 1030.11.2.1 through 1030.11.2.4.

1030.11.2.1 The travel distance between any room door required as an exit access and an exit shall not exceed 150 feet (45 720 mm).

1030.11.2.2 The travel distance between any point in a room and an exit shall not exceed 200 feet (60 960 mm).

1030.11.2.3 The travel distance between any point in a health care sleeping room and an exit access door in that room shall not exceed 50 feet (15 240 mm).

1030.11.2.4 The travel distance between any point in a suite of sleeping rooms as permitted by Section 1030.2 and an exit access door of that suite shall not exceed 100 feet (30 480 mm) and shall meet the requirements of Section 1030.11.2.2.

1030.12 Measurement of travel distance to exits. Travel distance shall be determined in accordance with Section 1015, but shall not exceed:

1. One-hundred feet (30 480 mm) between any room door required as exit access and an exit.
2. One-hundred-and-fifty feet (45 720 mm) between any point in a room and an exit.
3. Fifty feet (15 240 mm) between any point in a sleeping room and the door of that room.

Exceptions:

1. The travel distance above may be increased by 50 feet (15 240 mm) in rooms other than sleeping rooms when the building is protected throughout by an approved automatic sprinkler system or smoke control system.
2. The maximum permitted travel distance shall be increased to 100 feet (30 480 mm) in sprinklered or unsprinklered open dormitories where the enclosing walls of the dormitory space are of smoketight construction. Where travel distance to the exit access door from any point within the dormitory exceeds 50 feet (15 240 mm), a minimum of two exit access doors remotely located from each other shall be provided.

1030.13 Stairs.

1030.13.1 Spiral stairs meeting the requirements of Section 1009.9 are permitted for access to and between staff locations.

1030.13.2 Alternating tread stairways meeting the requirements of Section 1009.10 are permitted for access to and between staff locations subject to occupancy by no more

than three persons all capable of using the alternating tread stairway.

1030.13.3 Solid risers, intermediate handrails, latticework or similar facilities required by Sections 1009.3.2 and 1012.3 which would interfere with visual supervision of residents are not required.

SECTION 1031
MERCANTILE

1031.1 Stairs. Spiral stairs complying with Section 1009.9 shall be permitted as a component in a means of egress.

1031.2 Handrails and guardrails. Handrails and guardrails shall be installed in accordance with Sections 1009.11 and 1012.

Exception: In areas not accessible to the public and in fully enclosed stairways in Group M not serving a Group A, E or R occupancy, the clear distance between rails or ornamental pattern shall be such as to prevent the passage of a 21-inch (533 mm) diameter sphere.

1031.3 Common path of travel. In Group M buildings which are sprinklered throughout, a common path of travel not exceeding 100 feet (30 480 mm) shall be permitted.

SECTION 1032
RESIDENTIAL

1032.1 Stairways not part of the required means of egress and providing access from the outside grade level to the basement in Group R-3 occupancies shall be exempt from Section 1009 when the maximum height from the basement finished floor level to grade adjacent to the stair does not exceed 8 feet (2438 mm) and the grade level opening to the stair is covered by hinged doors or other approved means.

1032.2 Common path of travel. In Group R-1 and R-2 occupancies no common path of travel shall exceed 35 feet (10 668 mm). Travel within a guest room, guest suite or dwelling unit shall not be included when calculating common path of travel.

Exception: In buildings protected throughout by an approved, automatic sprinkler system a common path of travel shall not exceed 50 feet (15 240 mm).

1032.3 Travel distance in group R1 and R2 occupancies. In group R-1 and R-2 occupancies travel distance within a guest room, guest suite or dwelling unit to a corridor door shall not exceed 75 feet (22 860 mm) and allowed to be increased to125 feet when the building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 903.3.1.1.

SECTION 1033
STORAGE

1033.1 Aircraft servicing hangars.

1033.1.1 Exits from aircraft servicing areas shall be provided at intervals of not more than 150 feet (45 720 mm) on all exterior walls. There shall be a minimum of two means of egress from each aircraft servicing area. Horizontal exits through interior fire walls shall be provided at intervals of not more than 100 feet (30 480 mm) along the wall.

Exception: Dwarf or "smash" doors in doors used for accommodating aircraft shall be permitted for compliance with these requirements.

1033.1.2 Means of egress from mezzanine floors in aircraft servicing areas shall be arranged so that the maximum travel distance to reach the nearest exit from any point on the mezzanine shall not exceed 75 feet (23 m). Such means of egress shall lead directly to a properly enclosed stair discharging directly to the exterior, to a suitable cutoff area or to outside stairs.

1033.2 Stairs. Spiral stairs complying with Section 1009.9 shall be permitted as a component in a means of egress.

1033.3 Handrails and guardrails. Handrails and guardrails shall be installed in accordance with Sections 1009.11 and 1012.

Exception: In areas not accessible to the public in Group S, the clear distance between rails or ornamental pattern shall be such as to prevent the passage of a 21-inch (533 mm) diameter sphere.

1033.4 Common path of travel.

1033.4.1 In Group S-1 storage, occupancies common path of travel shall not exceed 50 feet (15 240 mm).

Exception: Common paths of travel shall not exceed 100 feet (30 480 mm) in buildings protected by an approved automatic sprinkler system.

1033.4.2 In Group S-2 storage, occupancies common paths of travel shall not be limited.

1033.4.3 A common path of travel for the first 50 feet (15 240 mm) from any point shall be permitted in parking structures.

SECTION 1034
DAY CARE

1034.1 Panic and fire exit hardware.

1034.1.1 Any door in a required means of egress from an area having an occupant load of 100 or more persons shall be permitted to be provided with a latch or lock only if it is panic hardware or fire exit hardware which releases when a force of no more than 15 pounds (67 N) is applied to the releasing devices in the direction of exit travel. Such releasing devices may be bars or panels extending not less than one-half the width of the door and placed at heights suitable for the service required, but not less than 34 inches (864 mm) nor more than 48 inches (1219 mm) above the floor. Whenever panic hardware is used on a labeled fire door, the panic hardware shall be labeled as fire exit hardware.

1034.1.2 If balanced doors are used and panic hardware is required, the panic hardware shall be of the push-pad type and the pad shall not extend more than one-half the width of the door measured from the latch side.

1034.2 Doors and corridors.

1034.2.1 Every room or space with an occupant load of more than 50 persons or an area of more than 1,000 square feet (93 m^2) shall have at least two exit access doorways as remotely located from each other as practicable. Such doorways shall provide access to separate exits, but where egress is through corridors, they shall be permitted to open onto a common corridor leading to separate exits located in opposite directions.

1034.2.2 Where the two exit accesses from a day care occupancy in an apartment building enter the same corridor as the apartment occupancy, the exit accesses shall be separated in the corridor by a smoke barrier having not less than a 1-hour fire-resistance rating constructed in accordance with Section 709. The smoke barrier shall be located so that it has an exit on each side.

1034.2.3 Doors designed to be normally closed shall comply with Section 715.3.7.

1034.3 A travel distance of 200 feet (60 960 mm) in unsprinklered buildings and 250 feet (76 200 mm) in buildings protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the following.

1. The travel distance between any room door intended as an exit access and an exit shall not exceed 100 feet (30 480 mm); and
2. The travel distance between any point in a room and an exit shall not exceed 150 feet (45 720 mm); and
3. The travel distance between any point in a sleeping room and an exit access door in that room shall not exceed 50 feet (15 240 mm).

   Exception: The travel distance in Items 1 and 2 above may be increased by 50 feet (15 240 mm) in buildings protected throughout by an approved supervised automatic sprinkler system.

1034.4 Illumination and marking of means of egress. Illumination and marking of means of egress shall comply with Section 1006.

1034.5 Emergency lighting. Emergency lighting in accordance with Section 1006.2 shall be provided in the following areas:

1. Interior stairs and corridors.
2. Normally occupied spaces.

   Exception: Administrative areas, general classrooms, mechanical rooms and storage areas.
3. Flexible and open plan buildings.
4. Interior or windowless portions of buildings.
5. Shops and laboratories.

1034.6 Special means of egress features. Every room or space normally subject to client occupancy, other than bathrooms, shall have at least one outside window for emergency rescue and ventilation. Such window shall be openable from the inside without the use of tools and shall provide a clear opening of not less than 20 inches (508 mm) in width, 24 inches (610 mm) in height, and 5.7 square feet (0.53 m^2) in area. The bottom of the opening shall be not more than 44 inches (1118 mm) above the floor. The clear opening shall permit a rectangular solid, with a minimum width and height that provides the required 5.7 square foot (0.53 m^2) opening and a minimum depth of 20 inches (8 mm), to pass fully through the opening.

Exceptions:

1. In buildings protected throughout by an approved, automatic sprinkler system.
2. Where the room or space has a door leading directly to the outside of the building.

1034.7 Flexible plan and open plan buildings. In day care occupancies, each room occupied by more than 300 persons shall have two or more means of egress entering into separate atmospheres. If three or more means of egress are required, not more than two of them shall enter into a common atmosphere.

1034.8 Group day care homes means of escape requirements.

1034.8.1 The provisions of Chapter 10 shall be applicable to means of escape in day care homes except as modified in this section.

1034.8.2 In group day care homes, every story occupied by clients shall have not less than two remotely located means of escape. Maximum travel distance shall be as specified in Section 1034.3.

1034.8.3 In group day care homes, every room used for sleeping, living or dining purposes shall have at least two means of escape, at least one of which shall be a door or stairway that provides a means of unobstructed travel to the outside of the building at street or ground level. The second means of escape may be a window in accordance with Section 1034.6. No room or space that is accessible only by a ladder or folding stairs or through a trap door shall be occupied for living or sleeping purposes.

1034.8.4 In group day care homes where spaces on the story above the story of exit discharge are used by clients, at least one means of escape shall be an exit discharging directly to the outside. The second means of escape may be a window in accordance with Section 1034.6.

1034.8.5 In group day care homes where clients occupy a story below the level of exit discharge, at least one means of escape shall be an exit discharging directly to the outside. The second means of escape may be a window in accordance with Section 1034.6. No facility shall be located more than one story below the ground. In day care homes, any stairway to the story above shall be cut off by a fire barrier containing a door that has at least a 20-minute fire protection rating and is equipped with a self-closing device.

1034.8.6 In group day care homes, every room or space normally subject to client occupancy, other than bathrooms, shall have at least one outside window for emergency rescue and ventilation complying with Section 1034.6.

Exceptions:

1. In buildings protected throughout by an approved, automatic sprinkler system.

2. Where the room or space has a door leading directly to the outside of the building.

1034.8.7 Where the two exit accesses from a group day care home in an apartment building enter the same corridor as the apartment occupancy, the exit accesses shall be separated in the corridor by a smoke barrier having not less than a 1-hour fire-resistance rating constructed in accordance with Section 709. The smoke barrier shall be located so that it has an exit on each side.

SECTION 1035
BOILER, FURNACE AND MECHANICAL EQUIPMENT ROOMS

1035.1 Single means of egress. Stories used exclusively for boilers, furnaces or mechanical equipment shall be permitted to have a single means of egress where the travel distance to an exit on that story does not exceed the common path of travel stipulated in Section 1035.2.

1035.2 Common path of travel. Boiler rooms, furnace rooms, mechanical equipment rooms and similar spaces shall have a common path of travel not exceeding 50 feet (15 240 mm).

Exceptions:

1. In buildings protected throughout with an approved automatic sprinkler system boiler rooms, furnace rooms, mechanical equipment rooms and similar spaces shall be permitted to have a common path of travel not exceeding 100 feet (30 480 mm).
2. Mechanical equipment rooms with no fuel-fired equipment shall be permitted to have a common path of travel not exceeding 100 feet (30 480 mm).

CHAPTER 11

FLORIDA ACCESSIBILITY CODE FOR BUILDING CONSTRUCTION PART A

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INTRODUCTION

In 1993 the Florida Legislature enacted the "Florida Americans with Disability Accessibility Implementation Act." The purpose and intent of this Act (Sections 553.501-553.513, ***Florida Statutes***) is to incorporate into the laws of Florida the accessibility requirements of the Americans with Disabilities Act of 1990, Public Law No. 101-336, 42 U.S.C. Section 12101 et. seq. ADA, while at the same time to maintain those provisions of Florida law that are more stringent than the ADA accessibility guidelines, that is, those provisions which are more favorable to the needs of the disabled. In 1997 the legislature amended the Act to complete the move to establish consistency of the Florida accessibility building code to the Federal ADA Accessibility Guidelines as adopted by the Department of Justice at 28 CFR part 36, Appendix A. Nothing in Section 553.501-553.513 is intended to expand or diminish the defenses available to a place of public accommodation under the Americans with Disabilities Act and the federal Americans with Disabilities Act Accessibility Guidelines, including, but not limited to, the readily achievable standard, and the standards applicable to alterations to places of public accommodation.

Accessibility is a multifaceted issue within the issues of life today. The legislative actions of the 101st Congress which implemented the Americans with Disabilities Act of 1990 and previous acts of the Florida Legislature have been combined in the following pages to reflect accessibility laws as they relate to most areas of construction in Florida. Areas of employment as related to accessibility and/or complaints would be the responsibility of the **Equal Employment Opportunity Commission, 1-800-669-4000 or 305-536-4491**.

Primarily because of the complexities of balancing the rights of the physically disabled and the technically specific requirements of the built environment, no single agency has been charged with enforcement of all issues pertaining to accessibility. The following is a listing of agencies and their statutory areas of responsibility for accessibility. A thorough attempt was made by the Department of Community Affairs at the time of publication of this document to ensure that this manual is a reflection of the laws of Florida and the administrative rules of each agency as these requirements relate to construction. Because individual agency rules may change, it is the responsibility of the design professional and the property owner to ensure compliance with subsequent revisions.

RESPONSIBLE AGENCIES

For issues pertaining to:

1. **H.U.D. Office of Fair Housing and Equal Opportunity Hot Line**
   Washington, D.C.
   Voice: 1-800-669-9777
   TTY:1-800-927-9275
   FAX: 1-202-708-1425
   www.hud.gov
   Atlanta, GA
   Voice: 1-404-331-4149
   Forms and Publications
   1-800-767-7468
   Florida State Offices
   Jacksonville
   Voice: 1-904-232-2627
   FAX: 1-904-232-3759
   Miami
   Voice: 1-305-536-4456
   FAX: 1-305-536-5765
   TTY: 1-305-536-4734
   Orlando
   Voice: 1-407-648-6441
   FAX: 1-407-648-6310
   Tampa
   Voice: 1-813-228-2026
   FAX: 1-813-228-2431
   TTY: 1-813-228-2115
   Florida Commission on Human Relations
   Voice: 1-850-488-7082
   Voice Message Service:
   1-800-342-8170
   TDD ASCII 1-800-955-1339
   TDD Baudot 1-800-955-8771
   Voice Relay Service:
   1-800-955-8770
   fchr.state.fl.us

2. **Public Telephone Installation and Placement**
   Florida Public Service Commission
   Voice: 1-800-342-3552
   Fax: 1-850-511-0809
   TDD: 1-800-955-8771
   www.floridapsc.com

3. **Government Parking Facilities**
   Traffic Operations Office
   Florida Department of Transportation
   Voice: 1-866-374-3368, ext. 5253
   FAX: 1-850-414-5251
   TDD: 1-850-921-0762

4. **Accessible Parking Placards:**
   Department of Highway Safety and Motor Vehicles
   Contact your local Tax Collector's Office. Contact numbers listed by county at:
   www.hsmv.state.fl.us/offices/

5. **Elevator Accessibility:**
   Department of Business Regulation
   Bureau of Elevator Inspection
   Automated Call System:
   1-850-487-1395, select Hotels & Restaurants, then Elevators
   www.state.fl.us/dbpr/hr/elevators

6. **Government Facilities (Standards for Design)**
   Department of Management Services
   Division of Building Construction
   Permits and Inspections
   Voice: 1-850-488-2856
   FAX: 1-850-487-9947
   fcn.state.fl.us/dms/dbc/

7. **Hospital and Health Care Facilities**
   Agency for Health Care Administration
   Office of Plans and Construction
   Voice: 1-850-487-0713
   FAX: 1-850-922-6483
   www.fdhc.state.fl.us/MCHQ/plans/

8. **Public Schools and State Universities**
   Florida Department of Education
   www.fldoe.org
   Educational Facilities
   Voice: 1-850-245-0494
   Fax: 1-850-245-9236
   www.firn.edu/doe/edfacil/
   Board of Trustees
   www.fldoe.org/trusteesLinks.asp

9. **State Prisons**
   Department of Corrections
   Facilities Services
   Voice: 1-850-487-1330
   www.dc.state.fl.us

10. **ADA Questions and Complaints**
    United States Department of Justice
    Voice: 1-800-514-0301
    TTY/TDD: 1-800-514-0383
    www.usdoj.gov/disabilities.htm

11. **Florida Accessibility and Waiver Questions**
    Codes and Standards
    Department of Community Affairs
    Voice: 1-850-487-1824
    FAX: 1-850-414-8436
    www.dca.state.fl.us

12. **Historic Preservation Office of Cultural and Historical Resources**
    Division of Historical Resources
    Voice: 1-850-245-6372
    FAX: 1-850-245-6437
    dhr.dos.state.fl.us/preservation

13. **Code Compliance and Enforcement Local Building Departments**

553.513 Enforcement. It shall be the responsibility of each local government and each code enforcement agency established pursuant to Section 553.80 to enforce the provisions of this part. This act expressly preempts the establishment of handicapped accessibility standards to the state and supersedes any county or municipal ordinance on the subject. However, nothing in this section shall prohibit municipalities and counties from enforcing the provisions of this act.

History.—s. 6, ch. 89-97; s. 2, ch. 93-183.

Note.—Former s. 553.495.

Department of Community Affairs

553.75(3) The department shall be responsible for the provision of administrative and staff-support services relating to the functions of the board with respect to matters within the jurisdiction of the board, the department shall be responsible for the implementation and faithful discharge of all decisions of the board made pursuant to its authority under the provisions of this part (Sections 553.501 through 553.513, *Florida Statute*) (see Section 553.506, *Florida Statutes*).

Florida Building Commission

553.506 Powers of the commission. In addition to any other authority vested in the Florida Building Commission by law, the commission, in implementing Sections. 553.501through 553.513, may, by rule, adopt revised and updated versions of the Americans with Disabilities Act Accessibility Guidelines in accordance with Chapter 120.

553.512 Modifications and waivers; advisory council. The Florida Building Commission shall provide by regulation criteria for granting individual modifications of, or exceptions from, the literal requirements of this part upon a determination of unnecessary, unreasonable, or extreme hardship, provided such waivers shall not violate federal accessibility laws and regulations and shall be reviewed by the Accessibility Advisory Council. (see Section 553.512, *Florida Statutes*).

(1)Notwithstanding any other provision of this subsection if an applicant for a waiver demonstrates economic hardship in accordance with 28 C.F.R. s. 36.403(f)(1), a waiver shall be granted. The commission may not consider waiving any of the requirements of Section 553.5041 unless the applicant first demonstrates that he or she has applied for and been denied waiver or variance from all local government zoning, subdivision regulations, or other ordinances that prevent compliance therewith. Further, the commission may not waive the requirement of Section 553.5041(5)(a) and (c)1 governing the minimum width of accessible routes and minimum width of accessible parking spaces.

(2) The Accessibility Advisory Council shall consist of the following seven members, who shall be knowledgeable in the area of accessibility for persons with disabilities. The secretary of community affairs shall appoint the following: a representative from the Advocacy Center for Persons with Disabilities, Inc.; a representative from the Division of Blind Services; a representative from the Division of Vocational Rehabilitation; a representative from a statewide organization representing the physically handicapped; a representative from the hearing impaired; a representative from the president, Florida Council of Handicapped Organizations; and a representative of the Paralyzed Veterans of America. The terms for the first three council members appointed subsequent to October 1, 1991, shall be four years; the terms for the next two council members appointed shall be for three years; and the terms for the next two members shall be for two years. Thereafter, all council member appointments shall be for terms of four years. No council member shall serve more than two four-year terms subsequent to October 1, 1991. Any member of the council may be replaced by the secretary upon three unexcused absences. Upon application made in the form provided, an individual waiver or modification may be granted by the commission so long as such modification or waiver is not in conflict with more stringent standards provided in another chapter.

(3) Members of the council shall serve without compensation, but shall be entitled to reimbursement for per diem and travel expenses as provided by Section 112.061.

(4) Meetings of the advisory council shall be held in conjunction with the regular meetings of the commission.

History.—s. 3, ch. 78-333; s. 1, ch. 82-46; s. 2, ch. 83-265; s. 25, ch. 86-220; s. 5, ch. 89-97; ss. 1, 5, 6, ch. 91-172; s. 5, ch. 91-429; s. 2, ch. 93-183; s. 10, ch. 97-76; s. 68, ch. 2000-141; s. 61, ch. 2000-154; s. 13, ch. 2002-293.

Note.—Former s. 553.49.

Criteria for reviewing applications for waivers are established by Rule 9B-7, Florida Administration Code.

General Note

If an official either waives an accessible element or feature or allows a change that does not provide equivalent facilitation, the fact that Department of Justice has certified the code itself will not constitute rebuttable evidence that the facility has been constructed or altered in accordance with the minimum accessibility requirements of the ADA.

The text enclosed in shaded boxes indicates changes to the ADA Accessibility Guidelines (ADAAG). Changes are based on requirements established by Florida law and requirements established by 28 CFR 36 Subpart A and D.

SECTION 11-1
PURPOSE

11-1.1 This code shall take effect October 1, 1997.

11-1.2 All new or altered buildings and facilities subject to this code which may be frequented in, lived in, or worked in by the public shall comply with this code.

11-1.3 This code establishes standards for accessibility to places of public accommodation and commercial facilities by individuals with disabilities. This code shall also apply: to state and local government facilities pursuant to Section 553.503, *Florida Statutes*; to private clubs pursuant to Section 553.505, *Florida Statutes*; and to residential buildings pursuant to section 553.504(2), *Florida Statutes*. It is to be applied during the design, construction, and alteration of such buildings and facilities as required by Section 553.501 through 553.512, *Florida Statutes*.

SECTION 11-2
GENERAL

11-2.1 Provisions for adults. The specifications in this code are based upon adult dimensions and anthropometrics.

11-2.2 Equivalent facilitation. Departures from particular technical and scoping requirements of this code by the use of other designs and technologies are permitted where the alternative designs and technologies used will provide substantially equivalent or greater access to and usability of the facility.

Departure from the explicit technical and scoping requirements of this code for any element voids any otherwise applicable presumption of rebuttable evidence that the element has been constructed or altered in accordance with the minimum accessibility requirements of the ADA.

SECTION 11-3
MISCELLANEOUS INSTRUCTIONS AND DEFINITIONS

11-3.1 Graphic conventions. Graphic conventions are shown in Table 1. Dimensions that are not marked minimum or maximum are absolute, unless otherwise indicated in the text or captions.

11-3.2 Dimensional tolerances. All dimensions are subject to conventional building industry tolerances for field conditions.

11-3.3 Notes. Reserved.

11-3.4 General terminology.

Comply with. Meet one or more specifications of the code.

If, if...then. Denotes a specification that applies only when the conditions described are present.

May. Denotes an option or alternative.

Shall. Denotes a mandatory specification or requirement.

Should. Denotes an advisory specification or recommendation.

11-3.5 Definitions.

ACCESS AISLE. An accessible pedestrian space between elements, such as parking spaces, seating, and desks, that provides clearances appropriate for use of the elements.

ACCESSIBLE. A site, building, facility, or portion thereof that complies with these guidelines.

ACCESSIBLE ELEMENT. An element specified by these guidelines (for example, telephone, controls and the like).

ACCESSIBLE ROUTE. A continuous unobstructed path connecting all accessible elements and spaces of a building or facility. Interior accessible routes may include corridors, floors, ramps, elevators, lifts, and clear floor space at fixtures. Exterior accessible routes may include parking access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps and lifts.

ACCESSIBLE SPACE. Space that complies with these guidelines.

ADAPTABILITY. The ability of certain building spaces and elements, such as kitchen counters, sinks and grab bars, to be added or altered so as to accommodate the needs of individuals with or without disabilities or to accommodate the needs of persons with different types or degrees of disability.

ADDITION. An expansion, extension, or increase in the gross floor area of a building or facility.

ADMINISTRATIVE AUTHORITY. A governmental agency that adopts or enforces regulations and guidelines for the design, construction, or alteration of buildings and facilities.

ALTERATION. A change to a building or facility made by, on behalf of, or for the use of a public accommodation or commercial facility, that affects or could affect the usability of the building or facility or part thereof. Alterations include, but are not limited to, remodeling, renovation, rehabilitation, reconstruction, historic restoration, changes or rearrangement of the structural parts or elements, and changes or rearrangement in the plan configuration of walls and full-height partitions. Normal maintenance, reroofing, painting or wallpapering, or changes to mechanical and electrical systems are not alterations unless they affect the usability of the building or facility.

AREA OF RESCUE ASSISTANCE. An area, which has direct access to an exit, where people who are unable to use stairs may remain temporarily in safety to await further instructions or assistance during emergency evacuation.

ASSEMBLY AREA. A room or space accommodating a group of individuals for recreational, educational, political, social, or amusement purposes, or for the consumption of food and drink.

AUTOMATIC DOOR. A door equipped with a power-operated mechanism and controls that open and close the door automatically upon receipt of a momentary actuating signal. The switch that begins the automatic cycle may be a photoelectric device, floor mat, or manual switch (see "Power-assisted door").

BUILDING. Any structure used and intended for supporting or sheltering any use or occupancy.

CIRCULATION PATH. An exterior or interior way of passage from one place to another for pedestrians, including, but not limited to, walks, hallways, courtyards, stairways and stair landings.

CLEAR. Unobstructed.

CLEAR FLOOR SPACE. The minimum unobstructed floor or ground space required to accommodate a single, stationary wheelchair and occupant.

CLOSED CIRCUIT TELEPHONE. A telephone with dedicated line(s) such as a house phone, courtesy phone or phone that must be used to gain entrance to a facility.

COMMERCE. Commerce means travel, trade, traffic, commerce, transportation, or communication:

(1) Among the several states;

(2) Between any foreign country or any territory or possession and any state; or

(3) Between points in the same state but through another state or foreign country.

COMMERCIAL FACILITIES. Commercial facilities means facilities

(1) Whose operations will affect commerce;

(2) That are intended for nonresidential use by a private entity; and

(3) That are not:

(a) Facilities that are not covered or expressly exempted from coverage under the Fair Housing Act of 1968, as amended (42 U.S.C. 3601-3631);

(b) Aircraft; or

(c) Railroad locomotives, railroad freight cars, railroad cabooses, commuter or intercity passenger rail cars (including coaches, dining cars, sleeping cars, lounge cars, and food service cars), and any other railroad cars described in Section 242 of the ADA or covered under Title II of the ADA, or railroad rights-of-way. For purposes of this definition, "rail" and "railroad" have the meaning given the term "railroad" in Section 202(e) of the Federal Railroad Safety Act of 1970 [45 U.S.C. 431(e)].

COMMON USE. Those interior and exterior rooms, spaces, or elements that are made available for the use of a restricted group of people (for example, occupants of a homeless shelter, the occupants of an office building, or the guests of such occupants).

CROSS SLOPE. The slope that is perpendicular to the direction of travel (see running slope).

CURB RAMP. A short ramp cutting through a curb or built up to it.

DETECTABLE WARNING. A standardized surface feature built in or applied to walking surfaces or other elements to warn visually impaired people of hazards on a circulation path.

DISABILITY. With respect to an individual, a physical or mental impairment that substantially limits one or more of the major life activities of such individual; a record of such an impairment; or being regarded as having such an impairment.

(1) The phrase physical or mental impairment means:

(a) Any physiological disorder or condition, cosmetic disfigurement, or an atomical loss affecting one or more of the following body systems: neurological; musculoskeletal; special sense organs; respiratory, including speech organs; cardiovascular; reproductive; digestive; genitourinary; hemic and lymphatic; skin; and endocrine;

(b) Any mental or psychological disorder such as mental retardation, organic brain syndrome, emotional or mental illness, and specific learning disabilities;

(c) The phrase physical or mental impairment includes, but is not limited to, such contagious and noncontagious diseases and conditions as orthopedic, visual, speech, and hearing impairments, cerebral palsy, epilepsy, muscular dystrophy, multiple sclerosis, cancer, heart disease, diabetes, mental retardation, emotional illness, specific learning disabilities, HIV disease (whether symptomatic or asymptomatic), tuberculosis, drug addiction, and alcoholism;

(d) The phrase physical or mental impairment does not include homosexuality or bisexuality.

(2) The phrase major life activities means functions such as caring for one's self, performing manual tasks, walking, seeing, hearing, speaking, breathing, learning and working.

(3) The phrase has a record of such an impairment means has a history of, or has been misclassified as having, a mental or physical impairment that substantially limits one or more major life activities.

(4) The phrase is regarded as having an impairment means:

(a) Has a physical or mental impairment that does not substantially limit major life activities but that is treated by a private entity as constituting such a limitation;

(b) Has a physical or mental impairment that substantially limits major life activities only as a result of the attitudes of others toward such impairment; or

(c) Has not of the impairments defined in paragraph (1) of this definition but is treated by a private entity as having such an impairment.

(5) The term "disability" does not include:

(a) Transvestism, transsexualism, pedophilia, exhibitionism, voyeurism, gender identity disorders not resulting from physical impairments, or other sexual behavior disorders;

(b) Compulsive gambling, kleptomania or pyromania; or

(c) Psychoactive substance use disorders resulting from current illegal use of drugs.

DWELLING UNIT. A single unit which provides a kitchen or food preparation area, in addition to rooms and spaces for living, bathing, sleeping, and the like. Dwelling units include a single-family home or a townhouse used as a transient group home; an apartment building used as a shelter; guestrooms in a hotel that provide sleeping accommodations and food preparation areas; and other similar facilities used on a transient basis. For purposes of this code, use of the term "dwelling unit" does not imply the unit is used as a residence.

EGRESS, MEANS OF. A continuous and unobstructed way of exit travel from any point in a building or facility to a public way. A means of egress comprises vertical and horizontal travel and may include intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, horizontal exits, courts and yards. An accessible means of egress is one that complies with this code and does not include stairs, steps, or escalators. Areas of rescue assistance or evacuation elevators may be included as part of accessible means of egress.

ELEMENT. An architectural or mechanical component of a building, facility, space, or site, e.g., telephone, curb ramp, door, drinking fountain, seating, or water closet.

ENTRANCE. Any access point to a building or portion of a building or facility used for the purpose of entering. An entrance includes the approach walk, the vertical access leading to the entrance platform, the entrance platform itself, vestibules if provided, the entry door(s) or gate(s), and the hardware of the entry door(s) or gate(s).

FACILITY. All or any portion of buildings, structures, site improvements, complexes, equipment, roads, walks, passageways, parking lots or other real or personal property located on a site.

GROUND FLOOR. Any occupiable floor less than one story above or below grade with direct access to grade. A building or facility always has at least one ground floor and may have more than one ground floor as where a split level entrance has been provided or where a building is built into a hillside.

MEZZANINE OR MEZZANINE FLOOR. That portion of a story which is an intermediate floor level placed within the story and having occupiable space above and below its floor.

MARKED CROSSING. A crosswalk or other identified path intended for pedestrian use in crossing a vehicular way.

MULTIPLE-FAMILY DWELLING. Any building containing more than two dwelling units.

OCCUPIABLE. A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes, or in which occupants are engaged at labor, and which is equipped with means of egress, light, and ventilation.

OPERABLE PART. A part of a piece of equipment or appliance used to insert or withdraw objects, or to activate, deactivate, or adjust the equipment or appliance (for example, coin slot, push-button, handle).

PATH OF TRAVEL.

(1) A path of travel includes a continuous, unobstructed way of pedestrian passage by means of which the altered area may be approached, entered, and exited, and which connects the altered area with an exterior approach (including sidewalks, streets, and parking areas), an entrance to the facility, and other parts of the facility.

(2) An accessible path of travel may consist of walks and sidewalks, curb ramps and other interior or exterior pedestrian ramps; clear floor paths through lobbies, corridors, rooms, and other improved areas; parking access aisles; elevators and lifts; or a combination of these elements.

(3) For the purposes of this part (Section 553.501 through 553.512, *Florida Statutes*), the term "path of travel" also includes the restrooms, telephones, and drinking fountains serving the altered area.

POWER-ASSISTED DOOR. A door used for human passage with a mechanism that helps to open the door, or relieves the opening resistance of a door, upon the activation of a switch or a continued force applied to the door itself.

PLACE OF PUBLIC ACCOMMODATION. A facility, operated by a private entity, whose operations affect commerce and fall within at least one of the following categories:

1. Places of lodging. An inn, hotel, motel, or other place of lodging, except for an establishment located within a building that contains not more than five rooms for rent or hire and that is actually occupied by the proprietor of the establishment as the residence of the proprietor. Resort condominiums are considered to be public lodging establishments pursuant to Section 509.242, *Florida Statutes*;
2. Establishments serving food and drink. A restaurant, bar, or other establishment serving food or drink;
3. Places of exhibition or entertainment. A motion picture house, theater, concert hall, stadium, or other place of exhibition or entertainment;
4. Places of public gathering. An auditorium, convention center, lecture hall, or other place of public gathering;
5. Sales or rental establishments. A bakery, grocery store, clothing store, hardware store, shopping center, or other sales or rental establishment;
6. Service establishments. A laundromat, dry-cleaner, bank, barber shop, beauty shop, travel service, shoe repair service, funeral parlor, gas station, office of an accountant or lawyer, pharmacy, insurance office,

professional office of a health care provider, hospital, or other service establishment;

7. Stations used for specified public transportation. A terminal, depot, or other station used for specified public transportation;
8. Places of public display or collection. A museum, library, gallery, or other place of public display or collection;
9. Places of recreation. A park, zoo, amusement park, or other place of recreation;
10. Places of education. A nursery, elementary, secondary, undergraduate, or postgraduate private school, or other place of education;
11. Social service center establishments. A day care center, senior citizen center, homeless shelter, food bank, adoption agency, or other social service center establishment;
12. Places of exercise or recreation. A gymnasium, health spa, bowling alley, golf course, or other place of exercise or recreation;

PRIMARY FUNCTION. A major activity for which the facility is intended. Areas that contain a primary function include, but are not limited to, offices and other work areas in which the activities of the public accommodation or other private entity using the facility are carried out. Mechanical rooms, boiler rooms, supply storage rooms, employee lounges or locker rooms, janitorial closets, entrances, corridors, and restrooms are not areas containing a primary function.

Alterations to an area containing a primary function:

(1) Alterations that affect the usability of or access to an area containing a primary function include, but are not limited to:

(a) Remodeling merchandise display areas or employee work areas in a department store;

(b) Replacing an inaccessible floor surface in the customer service or employee work areas of a bank;

(c) Redesigning the assembly line area of a factory; or

(d) Installing a computer center in an accounting firm.

(2) For the purposes of this section, alterations to windows, hardware, controls, electrical outlets, and signage shall not be deemed to be alterations that affect the usability of or access to an area containing a primary function.

PROFESSIONAL OFFICE OF A HEALTH CARE PROVIDER. A location where a person or entity, regulated by a state to provide professional services related to the physical or mental health of an individual, makes such services available to the public. The facility housing the "professional office of a health care provider" only includes floor levels housing at least one health care provider, or any floor level designed or intended for use by at least one health care provider.

PUBLIC USE. Interior or exterior rooms or spaces that are made available to the general public. Public use may be provided at a building or facility that is privately or publicly owned.

RAMP. A walking surface which has a running slope greater than 1:20.

READILY ACHIEVABLE. Readily achievable means easily accomplishable and able to be carried out without much difficulty or expense. In determining whether an action is readily achievable factors to be considered include—

(1) The nature and cost of the action needed under this part (Section 553.501 through 553.512, *Florida Statutes*);

(2) The overall financial resources of the site or sites involved in the action; the number of persons employed at the site; the effect on expenses and resources; legitimate safety requirements that are necessary for safe operation, including crime prevention measures; or the impact otherwise of the action upon the operation of the site;

(3) The geographic separateness, and the administrative or fiscal relationship of the site or sites in question to any parent corporation or entity;

(4) If applicable, the overall financial resources of any parent corporation or entity; the overall size of the parent corporation or entity with respect to the number of its employees; the number, type, and location of its facilities; and

(5) If applicable, the type of operation or operations of any parent corporation or entity, including the composition, structure, and functions of the workforce of the parent corporation or entity.

RESORT CONDOMINIUM. A resort condominium is any unit or group of units in a condominium, cooperative, or time-share plan which is rented more than three times a calendar year for periods of less than 30 days or one calendar month, whichever is less, or which is advertised or held out to the public as a place regularly rented for periods of less than 30 days or one calendar month, whichever is less.

RUNNING SLOPE. The slope that is parallel to the direction of travel (see "Cross slope").

SERVICE ENTRANCE. An entrance intended primarily for delivery of goods or services.

SHOPPING CENTER or SHOPPING MALL.

(1) A building housing five or more sales or rental establishments; or

(2) A series of buildings on a common site, either under common ownership or common control or developed either as one project or as a series of related projects, housing five or more sales or rental establishments. For purposes of this section, places of public accommodation of the types listed in Paragraph (5) of the definition of "Place of public accommodation" in this code are considered sales or rental establishments. The facility housing a "shopping center or shopping mall" only includes floor levels housing at least one sales or rental establishment, or any floor level designed or intended for use by at least one sales or rental establishment.

SIGNAGE. Displayed verbal, symbolic, tactile, and pictorial information.

SITE. A parcel of land bounded by a property line or a designated portion of a public right-of-way.

SITE IMPROVEMENT. Landscaping, paving for pedestrian and vehicular ways, outdoor lighting, recreational facilities, and the like, added to a site.

SLEEPING ACCOMMODATIONS. Rooms in which people sleep; for example, dormitory and hotel or motel guest rooms or suites.

SPACE. A definable area, e.g., room, toilet room, hall, assembly area, entrance, storage room, alcove, courtyard, or lobby.

STORY. That portion of a building included between the upper surface of a floor and upper surface of the floor or roof next above. If such portion of a building does not include occupiable space, it is not considered a story for purposes of this code. There may be more than one floor level within a story as in the case of a mezzanine or mezzanines.

STRUCTURAL FRAME. The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and all other members which are essential to the stability of the building as a whole.

TACTILE. An object that can be perceived using the sense of touch.

TEXT TELEPHONE. Machinery or equipment that employs interactive graphic (i.e., typed) communications through the transmission of coded signals across the standard telephone network. Text telephones can include, for example, devices known as TDDs (telecommunication display devices or telecommunication devices for deaf persons) or computers.

THEME PARK OR ENTERTAINMENT COMPLEX. (Section 509.0013(9), *Florida Statutes*). Theme park or entertainment complex means a complex comprised of at least 25 contiguous acres owned and controlled by the same business entity and which contains permanent exhibitions and a variety of recreational activities and has a minimum of 1 million visitors annually.

TRANSIENT LODGING. A building, facility, or portion thereof, excluding inpatient medical care facilities, that contains one or more dwelling units or sleeping accommodations. Transient lodging may include, but is not limited to, resorts, group homes, hotels, motels, and dormitories.

VEHICULAR WAY. A route intended for vehicular traffic, such as a street, driveway, or parking lot.

WALK. An exterior pathway with a prepared surface intended for pedestrian use, including general pedestrian areas such as plazas and courts.

SECTION 11-4
ACCESSIBLE ELEMENTS AND SPACES: SCOPE AND TECHNICAL REQUIREMENTS

11-4.1 Minimum requirements.

11-4.1.1 Application.

(1) General. This code establishes the minimum standards for the accessibility of buildings and facilities built or altered within the state.

(a) All areas of newly designed or newly constructed buildings and facilities required to be accessible by Section 11-4.1.2 and Section 11-4.1.3 and altered portions of existing buildings and facilities required to be accessible by Section 11-4.1.6 shall comply with this code, Section 11-4.1 through Section 11-4.35, unless otherwise provided in this section or as modified in a special application section.

(b) Removal of architectural barriers from buildings, structures, or facilities shall comply with Section 11-4.1.8 of this code unless compliance would render the removal not readily achievable. In no instance shall the removal of an architectural barrier create a significant risk to the health or safety of an individual with a disability or others.

(c) New single-family houses, duplexes, triplexes, condominiums, and townhouses shall comply with Section 11-11 of this code.

(2) Application based on building use. Special application Section 11-5 through Section 11-12 provide additional requirements for restaurants and cafeterias, medical care facilities, business and mercantile, libraries, accessible transient lodging, transportation facilities, residential buildings and theme park entertainment complexes. When a building or facility contains more than one use covered by a special application section, each portion shall comply with the requirements for that use.

(3) Areas used only by employees as work areas. Areas that are used only as work areas shall be designed and constructed so that individuals with disabilities can approach, enter, and exit the areas. This code does not require that any areas used only as work areas be constructed to permit maneuvering within the work area or be constructed or equipped (i.e., with racks or shelves) to be accessible.

(4) Temporary structures. This code covers temporary buildings or facilities as well as permanent facilities. Temporary buildings and facilities are not of permanent construction but are extensively used or are essential for public use for a period of time. Examples of temporary buildings or facilities covered by this code includes, but are not limited to: reviewing stands, temporary classrooms, bleacher areas, exhibit areas, temporary banking facilities, temporary health screening services, or temporary safe pedestrian passageways around a construction site. Structures, sites and equipment directly associated with the actual processes of construction, such as scaffolding, bridging, materials hoists, or construction trailers are not included.

(5) General exceptions.

(a) In new construction, a person or entity is not required to meet fully the requirements of this code where that person or entity can demonstrate that it is structurally impracticable to do so. Full compliance will be considered structurally impracticable only in those rare circumstances when the unique characteristics of terrain prevent the incorporation of accessibility features. If full compliance with the requirements of this code is structurally impracticable, a person or entity shall comply with the requirements to the extent it is not structurally impracticable. Any portion of the building or facility which can be made accessible shall comply to the extent that it is not structurally impracticable.

If providing accessibility in conformance with this section to individuals with certain disabilities (e.g., those who use wheelchairs) would be structurally impracticable, accessibility shall nonetheless be ensured to persons with other types of disabilities (e.g., those who use crutches or who have sight, hearing, or mental impairments) in accordance with this section.

(b) Accessibility is not required in nonoccupiable spaces accessed only by ladders, catwalks, crawl spaces, very narrow passageways, or freight (nonpassenger) elevators, and frequented only by service personnel for repair purposes; such spaces include, but are not limited to, elevator pits, elevator penthouses, piping or equipment catwalks.

(c) This edition of the code does not apply to buildings, structures or facilities which were either under construction or under contract for construction on or before October 1, 1997.

11-4.1.2 Accessible site and exterior facilities: new construction.

This edition of the code does not apply to buildings, structures, or facilities which were either under construction or under contract for construction on October 1,1997.

Nothing in this code shall be construed to relieve the owner of any building, structure or facility from the duty to provide vertical accessibility to all levels above and below the occupiable grade level, regardless of whether the code requires an elevator to be installed in such building, structure or facility, except: (1) elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks, and automobile lubrication and maintenance pits and platforms; (2) unoccupiable spaces, such as rooms, enclosed spaces, and storage spaces that are not designed for human occupancy, for public accommodations, or for work areas; and (3) occupiable spaces and rooms that are not open to the public and that house no more than five persons including, but not limited to, equipment control rooms and projection booths. However as provided in Section 553.509, *Florida Statutes*, buildings, structures, and facilities must, at a minimum, comply with the requirements of the ADAAG. Therefore, facilities subject to the ADAAG may be required to provide vertical access to areas otherwise exempt under Section 11-4.1.3(5) of this code.

An accessible site shall meet the following minimum requirements:

(1) At least one accessible route complying with Section 11-4.3 shall be provided within the boundary of the site from public transportation stops, accessible parking spaces, passenger loading zones if provided, and public streets or sidewalks, to an accessible building entrance.

(2) At least one accessible route complying with Section 11-4.3 shall connect accessible buildings, accessible facilities, accessible elements, and accessible spaces that are on the same site.

(3) All objects that protrude from surfaces or posts into circulation paths shall comply with Section 11-4.4.

(4) Ground surfaces along accessible routes and in accessible spaces shall comply with Section 11-4.5.

(5) Parking spaces:

(a) If parking spaces are provided for self-parking by employees or visitors, or both, then accessible spaces complying with Section 11-4.6 shall be provided in each such parking area. Such spaces shall be assigned and marked for exclusive use of those individuals who have a severe physical disability and have permanent or temporary mobility problems that substantially impair their ability to ambulate and who have been issued either a disabled parking permit under Section 316.1958 or 320.0848, *Florida Statutes*, or a license plate under Section 320.084, 320.0842, 320.0843, or 320.0845, *Florida Statutes*. The number of accessible parking spaces shall comply with the table below and the following:

Total Parking in Lot	Required Minimum Number of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2% of total
1001 and over	20 plus 1 for each 100 over 1000

(i) One space in the immediate vicinity of a publicly-owned or leased building which houses a governmental entity or a political subdivision, including, but not limited to, state office buildings and courthouses; if no parking for the public is provided on the premises of the building;

(ii) One space for each 150 metered on-street parking spaces provided by state agencies and political subdivisions.

(iii) The number of parking spaces for disabled persons shall be increased on the basis of demonstrated and documented need.

(b) In parking structures, one in every eight accessible spaces, but not less than one, shall be "van accessible" and shall be designed as required by Section 11-4.6.3. The vertical clearance at such spaces shall comply with Section 11-4.6.5. All such spaces may be grouped on one level of a parking structure. When such spaces are provided in a parking structure and only one in eight meet the height requirement of Section 11-4.6.5, they shall be designated as required by Section 11-4.6.4.

(c) If passenger loading zones are provided, then at least one passenger loading zone shall comply with Section 11-4.6.6.

(d) At facilities providing medical care and other services for persons with mobility impairments, parking spaces complying with Section 11-4.6 shall be provided in accordance with Section 11-4.1.2(5)(a) except as follows:

(i) Outpatient units and facilities: 10 percent of the total number of parking spaces provided serving each such outpatient unit or facility;

(ii) Units and facilities that specialize in treatment or services for persons with mobility impairments; 20 percent of the total number of parking spaces provided serving each such unit or facility.

(e) Valet parking. Valet parking facilities shall provide a passenger loading zone complying with Section 11-4.6.6 located on an accessible route to the entrance of the facility. Section 11-4.1.2(5)(a), Section 11-4.1.2(5)(b), and Section 11-4.1.2(5)(d) of this section do not apply to valet parking facilities.

(f) State agencies and political subdivisions having jurisdiction over street parking, or publicly owned or operated parking facilities are not required to provide a greater right-of-way width than would otherwise be planned under regulations, guidelines, or practices normally applied to new development.

(g) Theme park (see Section 12).

(6) If toilet facilities are provided on a site, then each such public or common use toilet facility shall comply with Section 11-4.22. If bathing facilities are provided on a site, then each such public or common use bathing facility shall comply with Section 11-4.23.

For single user portable toilet or bathing units clustered at a single location, at least 5 percent but no less than one toilet unit or bathing unit complying with Section 11-4.22 or 11-4.23 shall be installed at each cluster whenever typical inaccessible units are provided. Accessible units shall be identified by the International Symbol of Accessibility.

Exception: Portable toilet units at construction sites used exclusively by construction personnel are not required to comply with Section 11-4.1.2(6).

(7) Building signage. Signs which designate permanent rooms and spaces shall comply with Sections 11-4.30.1, 11-4.30.4, 11-4.30.5 and 11-4.30.6. Other signs which provide direction to, or information about, functional spaces of the building shall comply with Sections 11-4.30.1, 11-4.30.2, 11-4.30.3, and 11-4.30.5. Elements and spaces of accessible facilities which shall be identified by the International Symbol of Accessibility and which shall comply with Section 11-4.30.7 are:

(a) Parking spaces designated as reserved for individuals with disabilities;

(b) Accessible passenger loading zones;

(c) Accessible entrances when not all are accessible (inaccessible entrances shall have directional signage to indicate the route to the nearest accessible entrance);

(d) Accessible toilet and bathing facilities when not all are accessible.

11-4.1.3 Accessible buildings: new construction.

This edition of the code does not apply to buildings, structures, or facilities which were either under construction or under contract for construction on (or before) October 1, 1997.

(1) At least one accessible route complying with Section 11-4.3 shall connect accessible building or facility entrances with all accessible spaces and elements within the building or facility.

(2) All objects that overhang or protrude into circulation paths shall comply with Section 11-4.4.

(3) Ground and floor surfaces along accessible routes and in accessible rooms and spaces shall comply with Section 11-4.5.

(4) Interior and exterior stairs connecting levels that are not connected by an elevator, ramp, or other accessible means of vertical access shall comply with Section 11-4.9.

(5) One passenger elevator complying with Section 11-4.10 shall serve each level, including mezzanines, in all multistory buildings and facilities unless exempted below. If more than one elevator is provided, each full passenger elevator shall comply with Section 11-4.10. Vertical accessibility shall be provided to all levels above and below the occupiable grade level, regardless of whether the code requires an elevator to be installed in such building, structure or facility, except for: (1) elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks, and automobile lubrication and maintenance pits and platforms; (2) unoccupiable spaces, such as rooms, enclosed spaces, and storage spaces that are not designed for human occupancy, for public accommodations, or for work areas; and (3) occupiable spaces and rooms that are not open to the public and that house no more than five persons including, but not limited to, equipment control rooms and projection booths. However, as provided in Section 553.509, *Florida Statutes*, buildings, struc-

tures, and facilities must, at a minimum, comply with the requirements of ADAAG. Therefore, facilities subject to the ADA may be required to provide vertical access to areas otherwise exempt under Section 11-4.1.3(5)(3) of the code.

Exception 1: Elevators are not required in facilities that are less than three stories or that have less than 3,000 square feet (279 m^2) per story unless the building is a shopping center, a shopping mall, or the professional office of a health care provider, or another type of facility as determined by the U.S. Attorney General. The elevator exemption set forth in this paragraph does not obviate or limit in any way the obligation to comply with the other accessibility requirements established in Section 11-4.1.3. For example, floors above or below the accessible ground floor must meet the requirements of this section except for elevator service. If toilet or bathing facilities are provided on a level not served by an elevator, then a toilet or bathing facility must be provided on the accessible ground floor. In new construction if a building or facility is eligible for this exemption but a full passenger elevator is nonetheless planned, that elevator shall meet the requirements of Section 11-4.10 and shall serve each level in the building. A full passenger elevator that provides service from a garage to only one level of a building or facility is not required to serve other levels.

Exception 2: Elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks are exempted from this requirement.

Exception 3: Accessible ramps complying with Section 11-4.8 may be used in lieu of an elevator.

Exception 4: Platform lifts (wheelchair lifts) complying with Section 11-4.11 of this code may be used in lieu of an elevator where this section would require an elevator only under the following conditions:

(a) To provide an accessible route to a performing area in an assembly occupancy.

(b) To comply with the wheelchair viewing position line-of-sight and dispersion requirements of Section 11-4.33.3.

(c) To provide access to incidental occupiable spaces and rooms which are not open to the general public and which house no more than five persons, including but not limited to equipment control rooms and projection booths.

(d) To provide access where existing site constraints or other constraints make use of a ramp or an elevator infeasible.

(6) Windows. Reserved.

(7) Doors.

(a) At each accessible entrance to a building or facility, at least one door shall comply with Section 11-4.13.

(b) Within a building or facility, at least one door at each accessible space shall comply with Section 11-4.13.

(c) Each door that is an element of an accessible route shall comply with Section 11-4.13.

(d) Each door required by Section 11-4.3.10, Egress, shall comply with Section 11-4.13.

(8) In new construction, at a minimum, the requirements in Section 11-4.1.3(8)(a) and Section 11-4.1.3(8)(b) below shall be satisfied independently:

(a)(i) At least 50 percent of all public entrances [excluding those in Section 11-4.1.3(8)(b) below] must be accessible. At least one must be a ground-floor entrance. Public entrances are any entrances that are not loading or service entrances.

(ii) Accessible entrances must be provided in a number at least equivalent to the number of exits required by the applicable building/fire codes. (This paragraph does not require an increase in the total number of entrances planned for a facility.)

(iii) An accessible entrance must be provided to each tenancy in a facility (for example, individual stores in a strip shopping center).

One entrance may be considered as meeting more than one of the requirements in Section 11-4.1.3(8)(a). Where feasible, accessible entrances shall be the entrances used by the majority of people visiting or working in the building.

(b)(i) In addition, if direct access is provided for pedestrians from an enclosed parking garage to the building, at least one direct entrance from the garage to the building must be accessible.

(ii) If access is provided for pedestrians from a pedestrian tunnel or elevated walkway, one entrance to the building from each tunnel or walkway must be accessible.

One entrance may be considered as meeting more than one of the requirements in Section 11-4.1.3(8)(b).

Because entrances also serve as emergency exits whose proximity to all parts of buildings and facilities is essential, it is preferable that all entrances be accessible.

(c) If the only entrance to a building, or tenancy in a facility, is a service entrance, that entrance shall be accessible.

(d) Entrances which are not accessible shall have directional signage complying with Sections 11-4.30.1, 11-4.30.2, 11-4.30.3, and 11-4.30.5, which indicates the location of the nearest accessible entrance.

(9) In buildings or facilities, or portions of buildings or facilities, required to be accessible, accessible means of egress shall be provided in the same number as required for exits by local building/life safety regulations. Where a required exit from an occupiable level above or below a level of accessible exit discharge is not accessible, an area of rescue assistance shall be provided on each such level (in a number equal to that of inaccessible required exits). Areas of rescue assistance shall comply with Section 11-4.3.11. A horizontal exit, meeting the requirements of local building/life safety regulations, shall satisfy the requirement for an area of rescue assistance.

Exception: Areas of rescue assistance are not required in buildings or facilities having a supervised automatic sprinkler system.

(10) Drinking fountains.

(a) Where only one drinking fountain is provided on a floor, there shall be a drinking fountain which is accessible to individuals who use wheelchairs in accordance with Section 11-4.15 and one accessible to those who have difficulty bending or stooping. (This can be accommodated by the use of a "hi-lo" fountain; by providing one fountain accessible to those who use wheelchairs and one fountain at a standard height convenient for those who have difficulty bending; by providing a fountain accessible under Section 11-4.15 and a water cooler; or by such other means as would achieve the required accessibility for each group on each floor.)

(b) Where more than one drinking fountain or water cooler is provided on a floor, at least 50 percent of those provided shall comply with Section 11-4.15 and shall be on an accessible route.

(11) Toilet facilities. If toilet rooms are provided, then each public and common use toilet room shall comply with Section 11-4.22. Other toilet rooms provided for the use of occupants of specific spaces (i.e., a private toilet room for the occupant of a private office) shall be adaptable. If bathing rooms are provided, then each public and common use bathroom shall comply with Section 11-4.23. Accessible toilet rooms and bathing facilities shall be on an accessible route.

(12) Storage, shelving and display units.

(a) If fixed or built-in storage facilities such as cabinets, shelves, closets, and drawers are provided in accessible spaces, at least one of each type provided shall contain storage space complying with Section 11-4.25. Additional storage may be provided outside of the dimensions required by Section 11-4.25.

(b) Shelves or display units allowing self-service by customers in mercantile occupancies shall be located on an accessible route complying with Section 11-4.3. Requirements for accessible reach range do not apply.

(13) Controls and operating mechanisms in accessible spaces, along accessible routes, or as parts of accessible elements (for example, light switches and dispenser controls) shall comply with Section 11-4.27.

(14) If emergency warning systems are provided, then they shall include both audible alarms and visual alarms complying with Section 11-4.28. Sleeping accommodations required to comply with Section 11-9.3 shall have an alarm system complying with Section 11-4.28. Emergency warning systems in medical care facilities may be modified to suit standard health care alarm design practice.

(15) Detectable warnings shall be provided at locations as specified in Section 11-4.29.

(16) Building signage.

(a) Signs which designate permanent rooms and spaces shall comply with Sections 11-4.30.1, 11-4.30.4, 11-4.30.5 and 11-4.30.6.

(b) Other signs which provide direction to or information about functional spaces of the building shall comply with Sections 11-4.30.1, 11-4.30.2, 11-4.30.3, and 11-4.30.5.

Exception: Building directories, menus, and all other signs which are temporary are not required to comply.

(17) Public telephones.

(a) If public pay telephones, public closed circuit telephones, or other public telephones are provided, then they shall comply with Section 11-4.31.2 through Section 11-4.31.8 to the extent required by the following table:

Number of each type of telephone provided on each floor	Number of telephones required to comply with 11-4.31.2 through 11-4.31.8[1]
1 or more single unit	1 per floor
1 bank[2]	1 per floor
2 or more banks[2]	1 per bank. Accessible unit may be installed as a single unit in proximity (either visible or with signage) to the bank. At least one public telephone per floor shall meet the requirements for a forward reach telephone.[3]

[1] Additional public telephones may be installed at any height. Unless otherwise specified, accessible telephones may be either forward or side reach telephones.

[2] A bank consists of two or more adjacent public telephones, often installed as a unit.

[3] **Exception:** For exterior installations only, if dial tone first service is available, then a side reach telephone may be installed instead of the required forward reach telephone (i.e., one telephone in proximity to each bank shall comply with Section 11-4.31).

(b) All telephones required to be accessible and complying with Section 11-4.31.2 through Section 11-4.31.8 shall be equipped with a volume control. In addition, 25 percent, but never less than one, of all other public telephones provided shall be equipped with a volume control and shall be dispersed among all types of public telephones, including closed circuit telephones, throughout the building or facility. Signage complying with applicable provisions of Section 11-4.30.7 shall be provided.

(c) The following shall be provided in accordance with Section 11-4.31.9:

(i) If a total number of four or more public pay telephones (including both interior and exterior phones)

is provided at a site, and at least one is in an interior location, then at least one interior public text telephone shall be provided.

(ii) If an interior public pay telephone is provided in a stadium or arena, in a convention center, in a hotel with a convention center, or in a covered mall, at least one interior public text telephone shall be provided in the facility.

(iii) If a public pay telephone is located in or adjacent to a hospital emergency room, hospital recovery room, or hospital waiting room, one public text telephone shall be provided at each such location.

(d) Where a bank of telephones in the interior of a building consists of three or more public pay telephones, at least one public pay telephone in each such bank shall be equipped with a shelf and outlet in compliance with Section 11-4.31.9(2).

(18) If fixed or built-in seating or tables (including, but not limited to, study carrels and student laboratory stations), are provided in accessible public or common use areas, at least 5 percent, but not less than one, of the fixed or built-in seating areas or tables shall comply with Section 11-4.32. An accessible route shall lead to and through such fixed or built-in seating areas, or tables.

(19) Assembly areas.

(a) All public food service establishments, all establishments licensed under the beverage law for consumption on the premises, and places of assembly with fixed seating shall provide accessible seating or spaces for seating which comply with Sections 11-4.33.2, 11-4.33.3, and 11-4.33.4 and in accordance with the following requirements: For the first 100 seats, accessible and usable spaces shall be provided consistent with the following table:

Capacity of Seating in Assembly Areas	Number of Required Wheelchair Locations
1 to 25	1
26 to 50	2
51 to 100	4

For all remaining fixed seats, there shall be not less than one such accessible and usable space for each 100 fixed seats or fraction thereof.

In addition, 1 percent, but not less than one, of all fixed seats shall be aisle seats with no armrests on the aisle side, or removable or folding armrests on the aisle side. Each such seat shall be identified by a sign or marker. Signage notifying patrons of the availability of such seats shall be posted at the ticket office. Aisle seats are not required to comply with Section 11-4.33.4.

(b) This paragraph applies to assembly areas where audible communications are integral to the use of the space (e.g., concert and lecture halls, playhouses and movie theaters, meeting rooms, etc.). Such assembly areas, if (1) they accommodate at least 50 persons, or if they have audio-amplification systems, and (2) they have fixed seating, shall have a permanently installed assistive listening system complying with Section 11-4.33. For other assembly areas, a permanently installed assistive listening system, or an adequate number of electrical outlets or other supplementary wiring necessary to support a portable assistive listening system shall be provided. The minimum number of receivers to be provided shall be equal to 4 percent of the total number of seats, but in no case less than two. Signage complying with applicable provisions of Section 11-4.30 shall be installed to notify patrons of the availability of a listening system.

(20) Where automated teller machines are provided, each machine shall comply with the requirements of Section 11-4.34 except where two or more are provided at a location, then only one must comply.

Exception: Drive-up-only automated teller machines are not required to comply with Sections 11-4.34.2 and 11-4.34.3.

(21) Where dressing and fitting rooms are provided for use by the general public, patients, customers or employees, 5 percent, but never less than one, of dressing rooms for each type of use in each cluster of dressing rooms shall be accessible and shall comply with Section 11-4.35.

Examples of types of dressing rooms are those serving different genders or distinct and different functions as in different treatment or examination facilities.

11-4.1.4 Reserved.

11-4.1.5 Accessible buildings: Additions. Each addition to an existing building or facility shall be regarded as an alteration. Each space or element added to the existing building or facility shall comply with the applicable provisions of Section 11-4.1.1 to Section 11-4.1.3, minimum requirements for new construction, and the applicable technical specifications of Section11-4.2 through Section 11-4.35 and Section 11-5 through Section 11-10. Each addition that affects or could affect the usability of an area containing a primary function shall comply with Section 11-4.1.6(2).

11-4.1.6 Accessible buildings: Alterations.

This edition of the code does not apply to buildings, structures or facilities which were in existence on October 1,1997, unless:

(i) The building, structure or facility is being converted from residential to nonresidential or mixed use, as defined by local law.

(ii) The proposed alteration or renovation of the building, structure or facility will affect usability or accessibility to a degree which invokes the requirements of Section 303(a) of the ADA of 1990, or

(iii) The original construction or any former alteration or renovation of the building, structure or facility was carried out in violation of applicable permitting law:

(1) General. Alterations to existing buildings and facilities shall comply with the following:

(a) No alteration shall be undertaken which decreases or has the effect of decreasing accessibility or usability of a building or facility below the requirements for new construction at the time of alteration.

(b) If existing elements, spaces, or common areas are altered, then each such altered element, space, feature, or area shall comply with the applicable provisions of Section 11-4.1.1 to Section 11-4.1.3, minimum requirements for new construction. If the applicable provision for new construction requires that an element, space, or common area be on an accessible route, the altered element, space, or common area is not required to be on an accessible route except as provided in Section 11-4.1.6(2), alterations to an area containing a primary function.

(c) If alterations of single elements, when considered together, amount to an alteration of a room or space in a building or facility, the entire space shall be made accessible.

(d) No alteration of an existing element, space, or area of a building or facility shall impose a requirement for greater accessibility than that which would be required for new construction. For example, if the elevators and stairs in a building are being altered and the elevators are, in turn, being made accessible, then no accessibility modifications are required to the stairs connecting levels connected by the elevator. If stair modifications to correct unsafe conditions are required by other codes, the modifications shall be done in compliance with these guidelines unless technically infeasible.

(e) At least one interior public text telephone complying with Section 11-4.31.9 shall be provided if:

(i) Alterations to existing buildings or facilities with less than four exterior or interior public pay telephones would increase the total number to four or more telephones with at least one in an interior location; or

(ii) Alterations to one or more exterior or interior public pay telephones occur in an existing building or facility with four or more public telephones with at least one in an interior location.

(f) If an escalator or stair is planned or installed where none existed previously and major structural modifications are necessary for such installation, then a means of vertical access shall be provided that complies with the applicable provisions of Section 11-4.7, 11-4.8, 11-4.10, or 11-4.11.

Nothing in this section shall be construed to relieve the owner of any building, structure or facility from the duty to provide vertical accessibility to all levels above and below occupiable grade level, regardless of whether the code requires an elevator to be installed in such building, structure, or facility, except for: (1) elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks, and automobile lubrication and maintenance pits and platforms; (2) unoccupiable spaces, such as rooms, enclosed spaces, and storage spaces that are not designed for human occupancy, for public accommodations, or for work areas; and (3) occupiable spaces and rooms that are not open to the public and that house no more than five persons including, but not limited to, equipment control rooms and projection booths. However, as provided in Section 553.509, *Florida Statutes*, buildings, structures, and facilities must, at a minimum, comply with the requirements of the ADAAG. Therefore, facilities subject to the ADAAG may be required to provide vertical access to areas otherwise exempt under Section 11-4.1.3(5) of this code.

(g) In alterations, the requirements of Sections 11-4.1.3(9), 11-4.3.10 and 11-4.3.11 do not apply.

(h) Entrances: If a planned alteration entails alterations to an entrance, and the building has an accessible entrance, the entrance being altered is not required to comply with Section 11-4.1.3(8), except to the extent required by Section 11-4.1.6(2). If a particular entrance is not made accessible, appropriate accessible signage indicating the location of the nearest accessible entrance(s) shall be installed at or near the inaccessible entrance, such that a person with disabilities will not be required to retrace the approach route from the inaccessible entrance.

(i) If the alteration work is limited solely to the electrical, mechanical, or plumbing system, or to hazardous material abatement, or automatic sprinkler retrofitting, and does not involve the alteration of any elements or spaces required to be accessible under these guidelines, then Section 11-4.1.6(2) does not apply.

(j) **Exception:** In alteration work, if compliance with Section 11-4.1.6 is technically infeasible, the alteration shall provide accessibility to the maximum extent feasible. Any elements or features of the building or facility that are being altered and can be made accessible shall be made accessible within the scope of the alteration.

TECHNICALLY INFEASIBLE. With respect to an alteration of a building or a facility, it has little likelihood of being accomplished because existing structural conditions would require removing or altering a load-bearing member which is an essential part of the structural frame; or because other existing physical or site constraints prohibit modification or addition of elements, spaces, or features which are in full and strict compliance with the minimum requirements for new

construction and which are necessary to provide accessibility.

(k) Exception:

(i) This code does not require the installation of an elevator in an altered facility that is less than three stories or has less than 3,000 square feet (279 m^2) per story unless the building is a shopping center, a shopping mall, the professional office of a health care provider, or another type of facility as determined by the U. S. Attorney General.

(ii) The exemption provided in Paragraph (i) does not obviate or limit in any way the obligation to comply with the other accessibility requirements established in this code. For example, alterations to floors above or below the ground floor must be accessible regardless of whether the altered facility has an elevator. If a facility subject to the elevator exemption set forth in Paragraph (i) nonetheless has a full passenger elevator, that elevator shall meet, to the maximum extent feasible, the accessibility requirements of this code.

(iii) Nothing in this section shall be construed to relieve the owner of any building, structure or facility from the duty to provide vertical accessibility to all levels above and below occupiable grade level, regardless of whether the code requires an elevator to be installed in such building, structure, or facility, except for: (1) elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks, and automobile lubrication and maintenance pits and platforms; (2) unoccupiable spaces, such as rooms, enclosed spaces, and storage spaces that are not designed for human occupancy, for public accommodations, or for work areas; and (3) occupiable spaces and rooms that are not open to the public and that house no more than five persons including, but not limited to, equipment control rooms and projection booths. However, as provided in Section 553.509, *Florida Statutes*, buildings, structures, and facilities must, at a minimum, comply with the requirements of the ADAAG. Therefore, facilities subject to the ADAAG may be required to provide vertical access to areas otherwise exempt under Section 11-4.1.3(5) of this code.

(iv) A facility that is making alterations must comply with this section to the maximum extent feasible. If compliance with parking location requirements is not feasible, the facility may provide parking spaces at alternative locations for persons who have disabilities and provide appropriate signage directing persons who have a disability to alternative parking. The facility may not reduce the required number or dimensions of those spaces, nor may it unnecessarily increase the length of the accessible route from a parking space to the facility. The alteration must not create a significant risk to the health or safety of a person who has a disability or to that of others.

(2) Alterations to an area containing a primary function. In addition to the requirements of Section 11-4.1.6(1), an alteration that affects or could affect the usability of or access to an area containing a primary function shall be made so as to ensure that, to the maximum extent feasible, the path of travel to the altered area and the restrooms, telephones, and drinking fountains serving the altered area, are readily accessible to and usable by individuals with disabilities, unless such alterations are disproportionate to the overall alterations tin terms of cost and scope.

Alterations made to provide an accessible path of travel to altered areas shall be deemed disproportionate to the overall alteration when the cost exceeds 20 percent of the cost of the alteration to the primary function area.

Duty to provide accessible features in the event of disproportionality.

(1) When the cost of alterations necessary to make the path of travel to the altered area fully accessible is disproportionate to the cost of the overall alteration, the path of travel shall be made accessible to the extent that it can be made accessible without incurring disproportionate costs.

(2)(a) In choosing which accessible elements to provide, priority should be given to those elements that will provide the greatest access, in the following order:

(i) An accessible entrance;

(ii) An accessible route to the altered area:

(iii) At least one accessible restroom for each sex or a single unisex restroom:

(iv) Accessible telephones;

(v) Accessible drinking fountains; and

(vi) When possible, additional accessible elements such as parking, storage, and alarms.

(B) Series of smaller alterations.

(i) The obligation to provide an accessible path of travel may not be evaded by performing a series of small alterations to the area served by a single path of travel if those alterations could have been performed as a single undertaking.

(ii) If an area containing a primary function has been altered without providing an accessible path of travel to that area, and subsequent alterations of that area, or a different area on the same path of travel, are undertaken within three years of the original alteration, the total cost of alterations to the primary function areas on that path of travel during the preceding three-year period shall be considered in determining whether the cost of making that path of travel accessible is disproportionate.

(iii) Only alterations undertaken after January 26, 1992, shall be considered in determining if the cost of providing an accessible path of travel is

disproportionate to the overall cost of the alterations.

(3) Special technical provisions for alterations to existing buildings and facilities:

(a) Ramps. Curb ramps and interior or exterior ramps to be constructed on sites or in existing buildings or facilities where space limitations prohibit the use of a 1:12 slope or less may have slopes and rises as follows:

(i) A slope between 1:10 and 1:12 is allowed for a maximum rise of 6 inches (152 mm).

(ii) A slope between 1:8 and 1:10 is allowed for a maximum rise of 3 inches (76 mm). A slope steeper than 1:8 is not allowed.

(b) Stairs. Full extension of handrails at stairs shall not be required in alterations where such extensions would be hazardous or impossible due to plan configuration.

(c) Elevators.

(i) If safety door edges are provided in existing automatic elevators, automatic door reopening devices may be omitted (see Section 11-4.10.6).

(ii) Where existing shaft configuration or technicality prohibits strict compliance with Section 11-4.10.9, the minimum car plan dimensions may be reduced by the minimum amount necessary, but in no case shall the inside car area be smaller than 48 inches by 48 inches (1219 mm by 1219 mm).

(iii) Equivalent facilitation may be provided with an elevator car of different dimensions when usability can be demonstrated and when all other elements required to be accessible comply with the applicable provisions of Section 11-4.10. For example, an elevator of 47 inches by 69 inches (1195 mm by 1755 mm) with a door opening on the narrow dimension, could accommodate the standard wheelchair clearances shown in Figure 4.

(d) Doors.

(i) Where it is technically infeasible to comply with clear opening width requirements of Section 11-4.13.5, a projection of $^5/_8$ inch (16 mm) maximum will be permitted for the latch side stop.

(ii) If existing thresholds are $^3/_4$ inch (19 mm) high or less, and have (or are modified to have) a beveled edge on each side, they may remain.

(e) Toilet rooms.

(i) Where it is technically infeasible to comply with Section 11-4.22 or 11-4.23, the installation of at least one unisex toilet/bathroom per floor, located in the same area as existing toilet facilities, will be permitted in lieu of modifying existing toilet facilities to be accessible. Each unisex toilet room shall contain one water closet complying with Section 11-4.16 and one lavatory complying with Section 11-4.19, and the door shall have a privacy latch.

(ii) Where it is technically infeasible to install a required standard stall [see Figure 30(a)], or where other codes prohibit reduction of the fixture count (i.e., removal of a water closet in order to create a double-wide stall), either alternate stall [see Figure 30(b)] may be provided in lieu of the standard stall.

(iii) When existing toilet or bathing facilities are being altered and are not made accessible, signage complying with Sections 11-4.30.1, 11-4.30.2, 11-4.30.3, 11-4.30.5 and 11-4.30.7 shall be provided indicating the location of the nearest accessible toilet or bathing facility within the facility.

(f) Assembly areas.

(i) Where it is technically infeasible to disperse accessible seating throughout an altered assembly area, accessible seating areas may be clustered. Each accessible seating area shall have provisions for companion seating and shall be located on an accessible route that also serves as a means of emergency egress.

(ii) Where it is technically infeasible to alter all performing areas to be on an accessible route, at least one of each type of performing area shall be made accessible.

(g) Platform lifts (wheelchair lifts). In alterations, platform lifts (wheelchair lifts) complying with Section 11-4.11 and applicable to this code shall be used as part of an accessible route. The use of lifts is not limited to the four conditions in Exception 4 of Section 11-4.1.3(5).

(h) Dressing rooms. In alterations where technical infeasibility can be demonstrated, one dressing room for each sex on each level shall be made accessible. Where only unisex dressing rooms are provided, accessible unisex dressing rooms may be used to fulfill this requirement.

11-4.1.7 Accessible buildings: Historic preservation.

(1) Applicability.

(a) General rule. Alterations to a qualified historic building or facility shall comply with Section 11-4.1.6 , the applicable technical specifications of Section 11-4.2 through Section 11-4.35 and the applicable special application Section 11-5 through Section 11-10 unless it is determined in accordance with the procedures in Section 11-4.1.7(2) that compliance with the requirements for accessible routes (exterior and interior), ramps, entrances, or toilets would threaten or destroy the historic significance of the building or facility in which case the alternative requirements in Section 11-4.1.7(3) may be used for the feature.

Exceptions: Reserved.

(b) Definition. A qualified historic building or facility is a building or facility that is:

(i) Listed in or eligible for listing in the National Register of Historic Places; or

(ii) Designated as historic under an appropriate state or local law.

(2) Procedures.

(a) Alterations to qualified historic buildings and facilities subject to Section 106 of the National Historic Preservation Act.

(i) Section 106, Process. Section 106 of the National Historic Preservation Act (16 U.S.C. 470 f) requires that a federal agency with jurisdiction over a federal, federally assisted, or federally licensed undertaking consider the effects of the agency's undertaking on buildings and facilities listed in or eligible for listing in the National Register of Historic Places and give the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking prior to approval of the undertaking.

(ii) ADA application. Where alterations are undertaken to a qualified historic building or facility that is subject to Section 106 of the National Historic Preservation Act, the federal agency with jurisdiction over the undertaking shall follow the Section 106 process. If the state historic preservation officer or Advisory Council on Historic Preservation agrees that compliance with the requirements for accessible routes (exterior and interior), ramps, entrances, or toilets would threaten or destroy the historic significance of the building or facility, the alternative requirements in Section 11-4.1.7(3) may be used for the feature.

(b) Alterations to qualified historic buildings and facilities not subject to Section 106 of the National Historic Preservation Act. Where alterations are undertaken to a qualified historic building or facility that is not subject to Section 106 of the National Historic Preservation Act, if the entity undertaking the alterations believes that compliance with the requirements for accessible routes (exterior and interior), ramps, entrances, or toilets would threaten or destroy the historic significance of the building or facility and that the alternative requirements in Section 11-4.1.7(3) should be used for the feature, the entity should consult with the state historic preservation officer. If the state historic preservation officer agrees that compliance with the accessibility requirements for accessible routes (exterior and interior), ramps, entrances or toilets would threaten or destroy the historical significance of the building or facility, the alternative requirements in Section 11-4.1.7(3) may be used.

(c) Consultation with interested persons. Interested persons should be invited to participate in the consultation process, including state or local accessibility officials, individuals with disabilities, and organizations representing individuals with disabilities.

(d) Certified local government historic preservation programs. Where the state historic preservation officer has delegated the consultation responsibility for purposes of this section to a local government historic preservation program that has been certified in accordance with Section 101(c) of the National Historic Preservation Act of 1966 [16 U.S.C. 470a (c)] and implementing regulations (36 CFR 61.5), the responsibility may be carried out by the appropriate local government body or official.

(3) Historic preservation: Minimum requirements.

(a) At least one accessible route complying with Section 11-4.3 from a site access point to an accessible entrance shall be provided.

Exception: A ramp with a slope no greater than 1:6 for a run not to exceed 2 feet (610 mm) may be used as part of an accessible route to an entrance.

(b) At least one accessible entrance complying with Section 11-4.14 which is used by the public shall be provided.

Exception: If it is determined that no entrance used by the public can comply with Section 11-4.14, then access at any entrance not used by the general public but open (unlocked) with directional signage at the primary entrance may be used. The accessible entrance shall also have a notification system. Where security is a problem, remote monitoring may be used.

(c) If toilets are provided, then at least one toilet facility complying with Sections 11-4.22 and 11-4.1.6 shall be provided along an accessible route that complies with Section 11-4.3. Such toilet facility may be unisex in design.

(d) Accessible routes from an accessible entrance to all publicly used spaces on at least the level of the accessible entrance shall be provided. Access shall be provided to all levels of a building or facility in compliance with Section 11-4.1 whenever practical.

(e) Displays and written information, documents, etc., should be located where they can be seen by a seated person. Exhibits and signage displayed horizontally (e.g., open books), should be no higher than 44 inches (1120 mm) above the floor surface.

11-4.1.8 Accessible buildings, structures and facilities: Architectural barrier removal.

(1) Removal of architectural barriers, pursuant to 28 C.F.R. Subpart C S. 36.304, from buildings, structures or facilities to which this code applies shall comply with Section 11-4.1 to Section 11-4.35 unless compliance would render the removal not readily achievable. In no instance shall the removal of an architectural barrier create a significant risk to the health or safety of an individual with disabilities or others.

(2) Barriers at common or emergency entrances and exits of business establishments conducting business with the general public that are existing, under construction, or under contract for construction which would prevent a person from using such entrances or exits shall be removed.

(3) The removal of architectural barriers from a parking facility in accordance with 28 C.F.R. Section 36.304 or with Section 553.508, *Florida Statutes*, must comply with this section unless compliance would cause the barrier removal not to be readily achievable. If compliance would cause the barrier removal not to be readily achievable, a facility may provide parking spaces at alternative locations for persons who have disabilities and provide appropriate signage directing persons who have disabilities to the alternative parking if readily achievable. The facility may not reduce the required number or dimensions of those spaces, nor may it unreasonably increase the length of the accessible route from a parking space to the facility. The removal of an architectural barrier must not create a significant risk to the health or safety of an individual with disabilities or others.

11-4.2 Space allowance and reach ranges.

11-4.2.1 Wheelchair passage width. The minimum clear width for single wheelchair passage shall be 32 inches (815 mm) at a point and 36 inches (915 mm) continuously [see Figure 1 and Figure 24(e)].

11-4.2.2 Width for wheelchair passing. The minimum width for two wheelchairs to pass is 60 inches (1525 mm) (see Figure 2).

11-4.2.3 Wheelchair turning space. The space required for a wheelchair to make a 180-degree turn is a clear space of 60 inches (1525 mm) diameter [see Figure 3(a)] or a T-shaped space [see Figure 3(b)].

11-4.2.4 Clear floor or ground space for wheelchairs.

11-4.2.4.1 Size and approach. The minimum clear floor or ground space required to accommodate a single, stationary wheelchair and occupant is 30 inches by 48 inches (760 mm by 1220 mm) [see Figure 4(a)]. The minimum clear floor or ground space for wheelchairs may be positioned for forward or parallel approach to an object [see Figure 4(b) and Figure 4(c)]. Clear floor or ground space for wheelchairs may be part of the knee space required under some objects.

11-4.2.4.2 Relationship of maneuvering clearance to wheelchair spaces. One full unobstructed side of the clear floor or ground space for a wheelchair shall adjoin or overlap an accessible route or adjoin another wheelchair clear floor space. If a clear floor space is located in an alcove or otherwise confined on all or part of three sides, additional maneuvering clearances shall be provided as shown in Figure 4(d) and Figure 4(e).

11-4.2.4.3 Surfaces for wheelchair spaces. Clear floor or ground spaces for wheelchairs shall comply with Section 11-4.5.

11-4.2.5 Forward reach. If the clear floor space only allows forward approach to an object, the maximum high forward reach allowed shall be 48 inches (1220 mm). The minimum low forward reach is 15 inches (380 mm) [see Figure 5(a)]. If the high forward reach is over an obstruction, reach and clearances shall be as shown in Figure 5(b).

11-4.2.6 Side reach. If the clear floor space allows parallel approach by a person in a wheelchair, the maximum high side reach allowed shall be 54 inches (1370 mm) and the low side reach shall be no less than 9 inches (230 mm) above the floor [see Figure 6(a) and Figure 6(b)]. If the side reach is over an obstruction, the reach and clearances shall be as shown in Figure 6(c).

11-4.3 Accessible route.

11-4.3.1 General. All walks, halls, corridors, aisles, skywalks, tunnels, and other spaces that are part of an accessible route shall comply with Section 11-4.3.

11-4.3.2 Location.

(1) At least one accessible route within the boundary of the site shall be provided from public transportation stops, accessible parking, and accessible passenger loading zones, and public streets or sidewalks to the accessible building entrance they serve. The accessible route shall, to the maximum extent feasible, coincide with the route for the general public.

(2) At least one accessible route shall connect accessible buildings, facilities, elements, and spaces that are on the same site.

(3) At least one accessible route shall connect accessible building or facility entrances with all accessible spaces and elements and with all accessible dwelling units within the building or facility.

(4) An accessible route shall connect at least one accessible entrance of each accessible dwelling unit with those exterior and interior spaces and facilities that serve the accessible dwelling unit.

11-4.3.3 Width. The minimum clear width of an accessible route shall be 36 inches (915 mm) except at doors (see Section 11-4.13.5 and 11-4.13.6). If a person in a wheelchair must make a turn around an obstruction, the minimum clear width of the accessible route shall be as shown in Figure 7(a) and Figure 7(b).

Exception: Curb ramps that are a part of a required means of egress shall be not less than 44 inches (1118 mm) wide.

11-4.3.4 Passing space. If an accessible route has less than 60 inches (1525 mm) clear width, then passing spaces at least 60 inches by 60 inches (1525 mm by 1525 mm) shall be located at reasonable intervals not to exceed 200 feet (61 m). A T-intersection of two corridors or walks is an acceptable passing place.

11-4.3.5 Headroom. Accessible routes shall comply with Section 11-4.4.2.

11-4.3.6 Surface textures. The surface of an accessible route shall comply with Section 11-4.5.

11-4.3.7 Slope. An accessible route with a running slope greater than 1:20 is a ramp and shall comply with Section 11-4.8. Nowhere shall the cross slope of an accessible route exceed 1:50.

11-4.3.8 Changes in level. Changes in levels along an accessible route shall comply with Section 11-4.5.2. If an

accessible route has changes in level greater than $^1/_2$ inch (13 mm), then a curb ramp, ramp, elevator, or platform lift (as permitted in Section 11-4.1.3 and 11-4.1.6) shall be provided that complies with Section 11-4.7, 11-4.8, 11-4.10, or 11-4.11, respectively. An accessible route does not include stairs, steps, or escalators. See definition of "Egress, means of" in Section 11-3.5 [see Figure 7(c) and Figure 7(d)].

11-4.3.9 Doors. Doors along an accessible route shall comply with Section 11-4.13.

11-4.3.10 Egress. Accessible routes serving any accessible space or element shall also serve as a means of egress for emergencies or connect to an accessible area of rescue assistance.

11-4.3.11 Areas of rescue assistance.

11-4.3.11.1 Location and construction. An area of rescue assistance shall be one of the following:

(1) A portion of a stairway landing within a smokeproof enclosure (complying with local requirements).

(2) A portion of an exterior exit balcony located immediately adjacent to an exit stairway when the balcony complies with local requirements for exterior exit balconies. Openings to the interior of the building located within 20 feet (6 m) of the area of rescue assistance shall be protected with fire assemblies having a $^3/_4$ hour fire protection rating.

(3) A portion of a 1-hour fire-resistive corridor (complying with local requirements for fire-resistive construction and for openings) located immediately adjacent to an exit enclosure.

(4) A vestibule located immediately adjacent to an exit enclosure and constructed to the same fire-resistive standards as required for corridors and openings.

(5) A portion of a stairway landing within an exit enclosure which is vented to the exterior and is separated from the interior of the building with not less than 1-hour fire-resistive doors.

(6) When approved by the appropriate local authority, an area or a room which is separated from other portions of the building by a smoke barrier. Smoke barriers shall have a fire-resistive rating of not less than one hour and shall completely enclose the area or room. Doors in the smoke barrier shall be tight-fitting smoke-and-draft control assemblies having a fire protection rating of not less than 20 minutes and shall be self-closing or automatic closing. The area or room shall be provided with an exit directly to an exit enclosure. Where the room or area exits into an exit enclosure which is required to be of more than 1-hour fire-resistive construction, the room or area shall have the same fire-resistive construction, including the same opening protection, as required for the adjacent exit enclosure.

(7) An elevator lobby when elevator shafts and adjacent lobbies are pressurized as required for smokeproof enclosures by local regulations and when complying with requirements herein for size, communication, and signage. Such pressurization system shall be activated by smoke detectors on each floor located in a manner approved by the appropriate local authority. Pressurization equipment and its duct work within the building shall be separated from other portions of the building by a minimum 2-hour fire-resistive construction.

11-4.3.11.2 Size. Each area of rescue assistance shall provide at least two accessible areas each being not less than 30 inches by 48 inches (760 mm by 1220 mm). The area of rescue assistance shall not encroach on any required exit width. The total number of such 30-inch by 48-inch (760 mm by 1220 mm) areas per story shall be not less than one for every 200 persons of calculated occupant load served by the area of rescue assistance.

Exception: The appropriate local authority may reduce the minimum number of 30-inch by 48-inch (760 mm by 1220 mm) areas to one for each area of rescue assistance on floors where the occupant load is less than 200.

11-4.3.11.3 Stairway width Each stairway adjacent to an area of rescue assistance shall have a minimum clear width of 48 (1220 mm) inches between handrails.

11-4.3.11.4 Two-way communication. A method of two-way communication, with both visible and audible signals, shall be provided between each area of rescue assistance and the primary entry. The fire department or appropriate local authority may approve a location other than the primary entry.

11-4.3.11.5 Identification. Each area of rescue assistance shall be identified by a sign, which states "AREA OF RESCUE ASSISTANCE" and displays the International Symbol of Accessibility. The sign shall be illuminated when exit sign illumination is required. Signage shall also be installed at all inaccessible exits and where otherwise necessary to clearly indicate the direction to areas of rescue assistance. In each area of rescue assistance, instructions on the use of the area under emergency conditions shall be posted adjoining the two-way communication system.

11-4.4 Protruding objects.

11-4.4.1 General. Objects projecting from walls (for example, telephones) with their leading edges between 27 inches and 80 inches (685 mm and 2030 mm) above the finished floor shall protrude no more than 4 inches (102 mm) into walks, halls, corridors, passageways, or aisles [see Figure 8(a)]. Objects mounted with their leading edges at or below 27 inches (685 mm) above the finished floor may protrude any amount [see Figure 8(a) and Figure 8(b)]. Free-standing objects mounted on posts or pylons may overhang 12 in (305 mm) maximum from 27 inches to 80 inches (685 mm to 2030 mm) above the ground or finished floor [see Figure 8(c) and Figure 8(d)]. Protruding objects shall not reduce the clear width of an accessible route or maneuvering space [see Figure 8(e)].

11-4.4.2 Headroom. Walks, halls, corridors, passageways, aisles, or other circulation spaces shall have 80 inches (2030 mm) minimum clear head room [see Figure 8(a)]. If vertical clearance of an area adjoining an accessible route is reduced

to less than 80 inches (2032 mm) (nominal dimension), a barrier to warn blind or visually-impaired persons shall be provided [see Figure 8(c-1)].

11-4.5 Ground and floor surfaces.

11-4.5.1 General. Ground and floor surfaces along accessible routes and in accessible rooms and spaces including floors, walks, ramps, stairs, and curb ramps, shall be stable, firm, slipresistant, and shall comply with Section 11-4.5.

11-4.5.2 Changes in level. Changes in level up to $^1/_4$ inches (6 mm) may be vertical and without edge treatment [see Figure 7(c)]. Changes in level between $^1/_4$ inch and $^1/_2$ inch (6 mm and 13 mm) shall be beveled with a slope no greater than 1:2 [see Figure 7(d)]. Changes in level greater than $^1/_2$ inch (13 mm) shall be accomplished by means of a ramp that complies with Section 11-4.7 or 11-4.8.

11-4.5.3 Carpet. If carpet or carpet tile is used on a ground or floor surface, then it shall be securely attached; have a firm cushion, pad, or backing, or no cushion or pad; and have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. The maximum pile thickness shall be $^1/_2$ inch (13 mm) [see Figure 8(f)]. Exposed edges of carpet shall be fastened to floor surfaces and have trim along the entire length of the exposed edge. Carpet edge trim shall comply with Section 11-4.5.2.

11-4.5.4 Gratings. If gratings are located in walking surfaces, then they shall have spaces no greater than $^1/_2$ inch (13 mm) wide in one direction [see Figure 8(g)]. If gratings have elongated openings, then they shall be placed so that the long dimension is perpendicular to the dominant direction of travel [see Figure 8(h)].

11-4.6 Parking and passenger loading zones.

11-4.6.1 Minimum number. Parking spaces required to be accessible by Section 11-4.1 shall comply with Sections 11-4.6.2 through Section 11-4.6.5. Passenger loading zones required to be accessible by Section 11-4.1 shall comply with Section 11-4.6.5 and 11-4.6.6.

11-4.6.2 Location. Accessible parking spaces serving a particular building shall be located on the shortest safely accessible route of travel from adjacent parking to an accessible entrance. In parking facilities that do not serve a particular building, accessible parking shall be located on the shortest accessible route of travel to an accessible pedestrian entrance of the parking facility. In buildings with multiple accessible entrances with adjacent parking, accessible parking spaces shall be dispersed and located closest to the accessible entrances.

(1) All spaces must be located on an accessible route no less than 44 inches (1118 mm)wide so that users will not be compelled to walk or wheel behind parked vehicles.

(2) If a theme park or entertainment complex [as defined in Section 509.013(9), see definitions] provides parking in several lots or areas from which access to the theme park or entertainment complex is provided, a single lot or area may be designated for parking by persons who have disabilities, if the lot or area is located on the shortest safely accessible route to an accessible entrance to the theme park or entertainment complex or to transportation to such accessible entrance.

(3) On-street parallel parking spaces must be located either at the beginning or end of a block or adjacent to alley entrances.

11-4.6.3 Parking spaces. Each parking space must be no less than 12 feet (3658 mm) wide. Parking access aisles must be no less than 5 feet (1524 mm) wide and must be part of an accessible route to the building or facility entrance. Two accessible spaces may share a common access aisle [see Figure 9(a)]. The access aisle shall be striped diagonally to designate it as a no-parking zone. Curb ramps must be located outside of the disabled parking spaces and access aisles.

Exception: If a theme park or entertainment complex in which are provided continuous attendant services for directing individuals to marked accessible parking spaces or designated lots for parking by persons who have disabilities, the park or complex may provide parking spaces that comply with the alternatives specified in Section 11-12.

Parked vehicle overhangs shall not reduce the clear width of an accessible route. Parking spaces and access aisles shall be level with surface slopes not exceeding 1:50 (2 percent) in all directions.

Parallel parking spaces must be even with surface slopes, may match the grade of the adjacent travel lane, and must not exceed a cross slope of 1:50, where feasible. Such spaces shall be designed per Sections 11-4.6.2 through 11-4.6.5.

Exception: Access aisles are not required.

Curbs adjacent to such spaces must be of a height that will not interfere with the opening and closing of motor vehicle doors.

11-4.6.4 Signage. Each accessible parking space must be prominently outlined with blue paint, and must be repainted as necessary, to be clearly distinguishable as a parking space designated for persons who have disabilities and must be posted with a permanent above-grade sign bearing the international symbol of accessibility, meeting the requirements of color and design approved by the Department of Transportation, of Section 11-4.30.7 and the caption "PARKING BY DISABLED PERMIT ONLY." Such sign erected after October 1, 1996, must indicate the penalty for illegal use of the space.

Van accessible parking spaces located within a parking structure shall have an additional sign reading "VAN ACCESSIBLE" mounted below the symbol of accessibility. Such signs shall be located so they cannot be obscured by a vehicle parked in the space.

A theme park or an entertainment complex as defined in Section 509.013(9), *Florida Statutes*, in which accessible parking is located in designated lots or areas, the signage indicating the lot as reserved for accessible parking may be lo-

cated at the entrances to the lot in lieu of a sign at each parking space.

Exception: Theme parks or entertainment complexes providing alternative parking spaces pursuant to the exception to Section 11-4.6.3 shall provide the "VAN ACCESSIBLE" sign complying with this section.

11-4.6.5 Vertical clearance. Provide minimum vertical clearance of 114 inches (2895 mm) at accessible passenger loading zones and along at least one vehicle access route to such areas from site entrance(s) and exit(s). At parking spaces complying with Section 11-4.1.2(5)(b), provide minimum vertical clearance of 98 inches (2490 mm) at the parking space and along at least one vehicle access route to such spaces from site entrance(s) and exit(s).

Every nonresidential structure built on or after January 1, 1991, which is designed to use covered or underground parking as the primary available parking space, shall design the covered or underground parking facility to maintain a minimum height for the portion of the street-accessible level of the parking facility directly over van accessible parking spaces and for providing ingress and egress to such parking spaces of at least 98 inches (2489 mm). Signs shall be posted to warn operators of permanent disability-equipped vans that they cannot pass beyond a certain point due to height limitations. If compliance with this minimum height clearance requirement will cause the structure to exceed local height limitations imposed by local zoning, planning, or fire ordinances, or will result in the imposition of any additional requirements of such ordinances, the structure may exceed the height limitation specified in those codes as necessary to comply with the requirements of this section and is exempt from such additional requirements. Structures for which the plans were sealed by an architect prior to January 1, 1991, are exempt from this section.

11-4.6.6 Passenger loading zones. Passenger loading zones shall provide an access aisle at least 60 inches (1525 mm) wide and 20 feet (6096 mm) long adjacent and parallel to the vehicle pull-up space (see Figure 10). If there are curbs between the access aisle and the vehicle pull-up space, then a curb ramp complying with Section 11-4.7 shall be provided. Vehicle standing spaces and access aisles shall be level with surface slopes not exceeding 1:50 (2 percent) in all directions.

11-4.7 Curb ramps.

11-4.7.1 Location. Curb ramps complying with Section 11-4.7 shall be provided wherever an accessible route crosses a curb.

Curb ramps must be located outside of disabled parking spaces and access aisles.

11-4.7.2 Slope. Slopes of curb ramps shall comply with Section 11-4.8.2. The slope shall be measured as shown in Figure 11. Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes. Maximum slopes of adjoining gutters, road surface immediately adjacent to the curb ramp, or accessible route shall not exceed 1:20.

11-4.7.3 Width. The minimum width of a curb ramp shall be 36 inches (915 mm), exclusive of flared sides.

Exception: Curb ramps that are a part of a required means of egress shall be not less than 44 inches (1118 mm) wide.

11-4.7.4 Surface. Surfaces of curb ramps shall comply with Section 11-4.5.

11-4.7.5 Sides of curb ramps. Curb ramps located where pedestrians must use them and all curb ramps which are not protected by handrails or guardrails shall have flared sides with a slope not exceeding a ratio of 1:12. Curb ramps with returned curbs may be used where pedestrians would not normally walk across the ramp [see Figure 12(b)].

11-4.7.6 Built-up curb ramps. Built-up curb ramps shall be located so that they do not project into vehicular traffic lanes (see Figure 13).

11-4.7.7 Detectable warnings. A curb ramp shall have a detectable warning complying with Section 11-4.29.2. The detectable warning shall extend the full width and depth of the curb ramp.

11-4.7.8 Obstructions. Curb ramps shall be located or protected to prevent their obstruction by parked vehicles.

11-4.7.9 Location at marked crossings. Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides (see Figure 15).

11-4.7.10 Diagonal curb ramps. If diagonal (or corner type) curb ramps have returned curbs or other well-defined edges, such edges shall be parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have 48 inch (1220 mm) minimum clear space as shown in Figure 15(c) and Figure 15(d). If diagonal curb ramps are provided at marked crossings, the 48 inch (1220 mm) clear space shall be within the markings [see Figure 15(c) and Figure 15(d)]. If diagonal curb ramps have flared sides, they shall also have at least a 24 inch (610 mm) long segment of straight curb located on each side of the curb ramp and within the marked crossing [see Figure 15(c)].

11-4.7.11 Islands. Any raised islands in crossings shall be cut through level with the street or have curb ramps at both sides and a level area at least 48 inches (1220 mm) long between the curb ramps in the part of the island intersected by the crossings [see Figure 15(a) and Figure 15(b)].

11-4.8 Ramps.

11-4.8.1 General. Any part of an accessible route with a slope greater than 1:20 shall be considered a ramp and shall comply with Section 11-4.8.

11-4.8.2 Slope and rise. The least possible slope shall be used for any ramp. The maximum slope of a ramp in new construction shall be 1 to 12. The maximum rise for any run shall be 30 inches (760 mm) (see Figure 16). Curb ramps and ramps to be constructed on existing sites or in existing buildings or facilities may have slopes and rises as shown as allowed in Section 11-4.1.6(3)(a) if space limitations prohibit the use of a 1 to 12 slope or less (see Section 11-4.1.6).

11-4.8.3 Clear Width. The minimum clear width of a ramp shall be 36 inches (915 mm).

Exception: Ramps that are part of a required means of egress shall be not less than 44 inches wide (1118 mm).

11-4.8.4 Landings. Ramps shall have level landings at bottom and top of each ramp and each ramp run. Landings shall have the following features:

(1) The landing shall be at least as wide as the ramp run leading to it.

(2) All landings on ramps shall be not less than 60 inches (1524 mm) clear, and the bottom of each ramp shall have not less than 72 inches (1829 mm) of straight and level clearance.

(3) If ramps change direction at landings, the minimum landing size shall be 60 inches by 60 inches (1525 mm by 1525 mm).

(4) If a doorway is located at a landing, then the area in front of the doorway shall comply with Section 11-4.13.6.

11-4.8.5 Handrails. If a ramp run has a rise greater than 6 inches (150 mm) or a horizontal projection greater than 72 inches (1830 mm), then it shall have handrails on both sides. Handrails are not required on curb ramps or adjacent to seating in assembly areas. Handrails shall comply with Section 11-4.26 and shall have the following features:

(1) Handrails shall be provided along both sides of ramp segments. The inside handrail on switchback or dogleg ramps shall always be continuous.

(2) Handrails on ramps which are not continuous shall extend not less than 18 inches (457 mm) beyond the sloped segment at both the top and bottom, and shall be parallel to the floor or ground surface.

(3) The clear space between the handrail and the wall shall be $1^1/_2$ inches (38 mm).

(4) Gripping surfaces shall be continuous.

(5) Top of handrail gripping surfaces shall be mounted between 34 inches and 38 inches (865 mm and 965 mm) above ramp surfaces.

(6) Ends of handrails shall be either rounded or returned smoothly to floor, wall, or post.

(7) Handrails shall not rotate within their fittings.

11-4.8.6 Cross slope and surfaces. The cross slope of ramp surfaces shall be no greater than 1:50. Ramp surfaces shall comply with Section 11-4.5.

11-4.8.7 Edge protection. Ramps and landings with drop-offs shall have curbs, walls, railings, or projecting surfaces that prevent people from slipping off the ramp. Curbs shall be a minimum of 2 inches (50 mm) high (see Figure 17).

11-4.8.8 Outdoor conditions. Outdoor ramps and their approaches shall be designed so that water will not accumulate on walking surfaces.

11-4.9 Stairs.

11-4.9.1 Minimum number. Stairs required to be accessible by Section 11-4.1 shall comply with Section 11-4.9.

11-4.9.2 Treads and risers. On any given flight of stairs, all steps shall have uniform riser heights and uniform tread widths. Stair treads shall be no less than 11 inches (280 mm) wide, measured from riser to riser [see Figure 18(a)]. Open risers are not permitted.

11-4.9.3 Nosings. The undersides of nosing shall not be abrupt. The radius of curvature at the leading edge of the tread shall be no greater than $^1/_2$ inch (13 mm). Risers shall be sloped or the underside of the nosing shall have an angle not less than 60 degrees from the horizontal. Nosing shall project no more than $1^1/_2$ inches (38 mm) (see Figure 18).

11-4.9.4 Handrails. Stairways shall have handrails at both sides of all stairs. Handrails shall comply with Section 11-4.26 and shall have the following features:

(1) Handrails shall be continuous along both sides of stairs. The inside handrail on switchback or dogleg stairs shall always be continuous [see Figure 19(a) and Figure 19(b)].

(2) If handrails are not continuous, they shall extend at least 12 inches (305 mm) beyond the top riser and at least 12 inches (305 mm) plus the width of one tread beyond the bottom riser. At the top, the extension shall be parallel with the floor or ground surface. At the bottom, the handrail shall continue to slope for a distance of the width of one tread from the bottom riser; the remainder of the extension shall be horizontal [see Figure 19(c) and Figure 19(d)]. Handrail extensions shall comply with Section 11-4.4.

(3) The clear space between handrails and wall shall be $1^1/_2$ inches (38 mm).

(4) Gripping surfaces shall be uninterrupted by newel posts, other construction elements, or obstructions.

(5) Top of handrail gripping surface shall be mounted between 34 inches and 38 inches (865 mm and 965 mm) above stair nosing.

(6) Ends of handrails shall be either rounded or returned smoothly to floor, wall or post.

(7) Handrails shall not rotate within their fittings.

11-4.9.5 Detectable warnings at stairs. Reserved.

11-4.9.6 Outdoor conditions. Outdoor stairs and their approaches shall be designed so that water will not accumulate on walking surfaces.

11-4.10 Elevators.

11-4.10.1 General. Accessible elevators shall be on an accessible route and shall comply with Section 11-4.10 and with the ASME A17.1-1990, *Safety Code for Elevators and Escalators*. Freight elevators shall not be considered as meeting the requirements of this section unless the only elevators provided are used as combination passenger and freight elevators for the public and employees.

11-4.10.2 Automatic operation. Elevator operation shall be automatic. Each car shall be equipped with a self-leveling feature that will automatically bring the car to floor land-

ings within a tolerance of 1/2 inch (12.7 mm) under rated loading to zero loading conditions. This self-leveling feature shall be automatic and independent of the operating device and shall correct the overtravel or undertravel.

11-4.10.3 Hall call buttons. Call buttons in elevator lobbies and halls shall be centered at 42 inches (1065 mm) above the floor. Such call buttons shall have visual signals to indicate when each call is registered and when each call is answered. Call buttons shall be a minimum of 3/4 inch (19 mm) in the smallest dimension. The button designating the up direction shall be on top (see Figure 20). Buttons shall be raised or flush. Objects mounted beneath hall call buttons shall not project into the elevator lobby more than 4 inches (102 mm).

11-4.10.4 Hall lanterns. A visible and audible signal shall be provided at each hoistway entrance to indicate which car is answering a call. Audible signals shall sound once for the up direction and twice for the down direction or shall have verbal annunciators that say "up" or "down." Visible signals shall have the following features:

(1) Hall lantern fixtures shall be mounted so that their centerline is at least 72 inches (1830 mm) above the lobby floor (see Figure 20).

(2) Visual elements shall be at least 2 1/2 inches (64 mm) in the smallest dimension.

(3) Signals shall be visible from the vicinity of the hall call button (see Figure 20). In-car lanterns located in cars, visible from the vicinity of hall call buttons, and conforming to the above requirements, shall be acceptable.

11-4.10.5 Raised and Braille characters on hoistway entrances. All elevator hoist way entrances shall have raised and Braille floor designations provided on both jambs. The centerline of the characters shall be 60 inches (1525 mm) above finish floor. Such characters shall be 2 inches (50 mm) high and shall comply with Section 11-4.30.4. Permanently applied plates are acceptable if they are permanently fixed to the jambs (see Figure 20).

11-4.10.6 Door protective and reopening device. Elevator doors shall open and close automatically. They shall be provided with a reopening device that will stop and reopen a car door and hoist way door automatically if the door becomes obstructed by an object or per son. The device shall be capable of completing these operations without requiring contact for an obstruction passing through the opening at heights of 5 inches and 29 inches (125 mm and 735 mm) above finish floor (see Figure 20). Door reopening devices shall remain effective for at least 20 seconds. After such an interval, doors may close in accordance with the requirements of ASME A17.1-1990.

11-4.10.7 Door and signal timing for hall calls. The minimum acceptable time from notification that a car is answering a call until the doors of that car start to close shall be calculated from the following equation:

$$T = D/(1.5\ ft/s) \text{ or } T = D/(445\ mm/s)$$

where T = total time (in seconds) and D = distance (in feet or millimeters) from a point in the lobby or corridor 60 inches (1525 mm) directly in front of the farthest call button controlling that car to the centerline of its hoistway door (see Figure 21). For cars with in-car lanterns, *T* begins when the lantern is visible from the vicinity of hall call buttons and an audible signal is sounded. The minimum acceptable notification time shall be 5 seconds.

11-4.10.8 Door delay for car calls. The minimum time for elevator doors to remain fully open in response to a car call shall be 3 seconds.

11-4.10.9 Floor plan of elevator cars. The floor area of elevator cars shall provide space for wheelchair users to enter the car, maneuver within reach of controls, and exit from the car. Acceptable door opening and inside dimensions shall be as shown in Figure 22. The clearance between the car platform sill and the edge of any hoist way landing shall be no greater than 1 1/4 inches (32 mm).

11-4.10.10 Floor surfaces. Floor surfaces shall comply with Section 11-4.5.

11-4.10.11 Illumination levels. The level of illumination at the car controls, platform, and car threshold and landing sill shall be at least 5 footcandles (53.8 lux).

11-4.10.12 Car controls. Elevator control panels shall have the following features:

(1) Buttons. All control buttons shall be at least 3/4 inch (19 mm) in their smallest dimension. They shall be raised or flush.

(2) Tactile, Braille, and visual control indicators. All control buttons shall be designated by Braille and by raised standard alphabet characters for letters, Arabic characters for numerals, or standard symbols as shown in Figure 23(a), and as required in ASME A17.1-1990. Raised and Braille characters and symbols shall comply with Section11-4.30. The call button for the main entry floor shall be designated by a raised star at the left of the floor designation [see Figure 23(a)]. All raised designations for control buttons shall be placed immediately to the left of the button to which they apply. Applied plates, permanently attached, are an acceptable means to provide raised control designations. Floor buttons shall be provided with visual indicators to show when each call is registered. The visual indicators shall be extinguished when each call is answered.

(3) Height. All floor buttons shall be no higher than 54 inches (1370 mm) above the finish floor for side approach and 48 inches (1220 mm) for front approach. Emergency controls, including the emergency alarm and emergency stop, shall be grouped at the bottom of the panel and shall have their centerlines no less than 35 inches (890 mm) above the finish floor [see Figure 23(a) and Figure 23(b)].

(4) Location. Controls shall be located on a front wall if cars have center opening doors, and at the side wall or at the front wall next to the door if cars have side opening doors [see Figure 23(c) and Figure 23(d)].

11-4.10.13 Car position indicators. In elevator cars, a visual car position indicator shall be provided above the car control panel or over the door to show the position of the elevator in the hoist way. As the car passes or stops at a floor

served by the elevators, the corresponding numerals shall illuminate, and an audible signal shall sound. Numerals shall be a minimum of 1/2 inch (12.7 mm) high. The audible signal shall be no less than 20 decibels with a frequency no higher than 1500 Hz. An automatic verbal announcement of the floor number at which a car stops or which a car passes may be substituted for the audible signal.

11-4.10.14 Emergency communications. If provided, emergency two-way communication systems between the elevator and a point outside the hoist way shall comply with ASME A17.1-1990. The highest operable part of a two-way communication system shall be a maximum of 48 inches (1219 mm) from the floor of the car. It shall be identified by a raised symbol and lettering complying with 11-4.30 and located adjacent to the device. If the system uses a handset then the length of the cord from the panel to the handset shall be at least 29 inches (735 mm). If the system is located in a closed compartment the compartment door hardware shall conform to Section 11-4.27, controls and operating mechanisms. The emergency intercommunication system shall not require voice communication.

11-4.11 Platform lifts (wheelchair lifts).

11-4.11.1 Location. Platform lifts (wheelchair lifts) permitted by Section 11-4.1 shall comply with the requirements of Section 11-4.11.

11-4.11.2 Other requirements. If platform lifts (wheelchair lifts) are used, they shall comply with Sections 11-4.2.4, 11-4.5, 11-4.27, and ASME A17.1, *Safety Code for Elevators and Escalators*, Section XX, 1990.

11-4.11.3 Entrance. If platform lifts are used then they shall facilitate unassisted entry, operation, and exit from the lift in compliance with Section 11-4.11.2.

11-4.12 Windows.

11-4.12.1 General. Reserved.

11-4.12.2 Window hardware. Reserved.

11-4.13 Doors.

11-4.13.1 General.

(1) Doors required to be accessible by Section 11-4.1 shall comply with the requirements of Section 11-4.13.

(2) All required doors and walk through openings in buildings excluding single family homes, duplexes, and triplexes not covered by the Americans with Disabilities Act of 1990 or the Fair Housing Act shall have at least 29 inches (737 mm) of clear width. [see Section11-4.22.2(1), exception].

11-4.13.2 Revolving doors and turnstiles.

(1) Revolving doors or turnstiles shall not be the only means of passage at an accessible entrance or along an accessible route. An accessible gate or door shall be provided adjacent to the turnstile or revolving door and shall be so designed as to facilitate the same use pattern.

(2) Turnstiles shall not be used in occupancies which serve fewer than 100 persons, but turnstiles may be used in occupancies which serve at least 100 persons if there is an unlocked alternate passageway on an accessible route affording not less than 32 inches (813 mm) of clearance, equipped with latching devices in accordance with this code.

11-4.13.3 Gates. Gates, including ticket gates, shall meet all applicable specifications of Section 11-4.13.

11-4.13.4 Double-leaf doorways. If doorways have two independently operated door leaves, then at least one leaf shall meet the specifications in Section 11-4.13.5 and Section 11-4.13.6. That leaf shall be an active leaf.

11-4.13.5 Clear width. Doorways shall have a minimum clear opening of 32 inches (813 mm) with the door open 90 degrees, measured between the face of the door and the opposite stop [see Figure 24(a), Figure 24(b), Figure 24(c), and Figure 24(d)]. Openings more than 24 inches (610 mm) in depth shall comply with Sections 11-4.2.1 and 11-4.3.3 [see Figure 24(e)].

Exception: Doors not requiring full user passage, such as shallow closets, may have the clear opening reduced to 20 inches (510 mm) minimum.

11-4.13.6 Maneuvering clearances at doors. Minimum maneuvering clearances at doors that are not automatic or power-assisted shall be as shown in Figure 25. The floor or ground area within the required clearances shall be level and clear.

Exception: Entry doors to acute care hospital bedrooms for in-patients shall be exempted from the requirement for space at the latch side of the door (see dimension "x" in Figure 25) if the door is at least 44 inches (1120 mm) wide.

11-4.13.7 Two doors in series. The minimum space between two hinged or pivoted doors in series shall be 48 inches (1219 mm) plus the width of any door swinging into the space. Doors in series shall swing either in the same direction or away from the space between the doors [see Figure 26(a)].

11-4.13.8 Thresholds at doorways. Thresholds at doorways shall not exceed 3/4 inch (19 mm) in height for exterior sliding doors or 1/2 inch (12.7 mm) for other types of doors. Raised thresholds and floor level changes at accessible doorways shall be beveled with a slope no greater than 1:2 (see Section 11-4.5.2).

11-4.13.9 Door hardware. Handles, pulls, latches, locks, and other operating devices on accessible doors shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist to operate. Lever-operated mechanisms, push-type mechanisms, and U-shaped handles are acceptable designs. When sliding doors are fully open, operating hardware shall be exposed and usable from both sides. Hardware required for accessible door passage shall be mounted no higher than 48 inches (1219 mm) above finish floor.

11-4.13.10 Door closers. If a door has a closer, then the sweep period of the closer shall be adjusted so that from an open position of 70 degrees, the door will take at least 3 sec-

onds to move to a point 3 inches (76 mm) from the latch, measured to the leading edge of the door.

11-4.13.11 Door opening force. The maximum force for pushing or pulling open a door shall be as follows:

(1) Fire doors shall have the minimum opening force allowable by the appropriate administrative authority.

(2) Other doors.

(a) Exterior hinged doors shall be so designed that such doors can be pushed or pulled open with a force not exceeding 8.5 lbf (37.8 N).

(b) Interior hinged doors: 5 lbf (22.2 N)

(c) Sliding or folding doors: 5 lbf (22.2 N)

These forces do not apply to the force required to retract latch bolts or disengage other devices that may hold the door in a closed position.

11-4.13.12 Automatic doors and power-assisted doors. If an automatic door is used, then it shall comply with ANSI/BHMA A156.10-1985. Slowly opening, low-powered, automatic doors shall comply with ANSI A156.19-1984. Such doors shall not open to back check faster than 3 seconds and shall require no more than 15 lbf (66.6 N) to stop door movement. If a power-assisted door is used, its door-opening force shall comply with Section 11-4.13.11 and its closing shall conform to the requirements in ANSI A156.19-1984.

11-4.14 Entrances.

11-4.14.1 Minimum number. Entrances required to be accessible by Section 11-4.1 shall be part of an accessible route complying with Section 11-4.3. Such entrances shall be connected by an accessible route to public transportation stops, to accessible parking and passenger loading zones, and to public streets or sidewalks if available [see Section 11-4.3.2(1)]. They shall also be connected by an accessible route to all accessible spaces or elements within the building or facility.

11-4.14.2 Service entrances. A service entrance shall not be the sole accessible entrance unless it is the only entrance to a building or facility (for example, in a factory or garage).

11-4.15 Drinking fountains and water coolers.

11-4.15.1 Minimum number. Drinking fountains or water coolers required to be accessible by Section 11-4.1 shall comply with Section 11-4.15.

11-4.15.2 Spout height. Spouts shall be no higher than 36 inches (915 mm), measured from the floor or ground surfaces to the spout outlet [see Figure 27(a)].

11-4.15.3 Spout location. The spouts of drinking fountains and water coolers shall be at the front of the unit and shall direct the water flow in a trajectory that is parallel or nearly parallel to the front of the unit. The spout shall provide a flow of water at least 4 inches (102 mm) high so as to allow the insertion of a cup or glass under the flow of water. On an accessible drinking fountain with a round or oval bowl, the spout must be positioned so the flow of water is within 3 inches (76 mm) of the front edge of the fountain.

11-4.15.4 Controls. Controls shall comply with Section 11-4.27.4. Unit controls shall be front mounted or side mounted near the front edge.

11-4.15.5 Clearances.

(1) Wall- and post-mounted cantilevered units shall have a clear knee space between the bottom of the apron and the floor or ground at least 27 inches (685 mm) high, 30 inches (760 mm) wide, and 17 inches to 19 inches (430 mm to 485 mm) deep [see Figure 27(a) and Figure 27(b)]. Such units shall also have a minimum clear floor space 30 inches by 48 inches (760 mm by 1219 mm) to allow a person in a wheelchair to approach the unit facing forward.

(2) Free-standing or built-in units not having a clear space under them shall have a clear floor space at least 30 inches by 48 inches (760 mm by 1219 mm) that allows a person in a wheelchair to make a parallel approach to the unit [see Figure 27(c) and Figure 27(d)]. This clear floor space shall comply with Section11-4.2.4.

11-4.16 Water closets.

11-4.16.1 General. Accessible water closets shall comply with Section 11-4.16.

11-4.16.2 Clear floor space. Clear floor space for water closets not in stalls shall comply with Figure 28. Clear floor space may be arranged to allow either a left-handed or right-handed approach.

11-4.16.3 Height. The height of water closets shall be 17 inches to 19 inches (430 mm to 485mm) measured to the top of the toilet seat [see Figure 29(b)]. Seats shall not be sprung to return to a lifted position.

11-4.16.4 Grab bars. Grab bars for water closets not located in stalls shall comply with Section 11-4.26 and Figure 29. The grab bar behind the water closet shall be 36 inches (915 mm) minimum.

11-4.16.5 Flush controls. Flush controls shall be hand operated or automatic and shall comply with Section 11-4.27.4. Controls for flush valves shall be mounted on the wide side of toilet areas no more than 44 inches (1120 mm) above the floor.

11-4.16.6 Dispensers. Toilet paper dispensers shall be installed within reach, as shown in Figure 29(b). Dispensers that control delivery, or that do not permit continuous paper flow, shall not be used.

11-4.17 Toilet stalls.

11-4.17.1 Location. Accessible toilet stalls shall be on an accessible route and shall meet the requirements of Section 11-4.17.

11-4.17.2 Water closets. Water closets in accessible stalls shall comply with Section 11-4.16.

11-4.17.3 Size and arrangement. The size and arrangement of the standard toilet stall shall comply with Figure 30(a), Standard Stall. Standard toilet stalls with a minimum depth of 56 inches (1420 mm) [see Figure 30(a)] shall have wall-mounted water closets. If the depth of a standard toilet

stall is increased at least 3 inches (76 mm), then a floor-mounted water closet may be used. Arrangements shown for standard toilet stalls may be reversed to allow either a left-or right-hand approach. Additional stalls shall be provided in conformance with Section 11-4.22.4

Exception: In instances of alteration work where provision of a standard stall [see Figure 30(a)] is technically infeasible or where plumbing code requirements prevent combining existing stalls to provide space, either alternate stall [see Figure 30(b)] may be provided in lieu of the standard stall.

Exception: New construction.

(1) The standard accessible restroom stall shall contain an accessible lavatory within it, the size of such lavatory to be not less than 19 inches wide by 17 inches (483 mm by 432 mm) deep, nominal size, and wall mounted. The lavatory shall be mounted so as not to overlap the clear floor space areas required by Section 11-4.17 [see Figure 30(a) and Figure 30(e)] and to comply with Section 11-4.19 of the code. Such lavatories shall be counted as part of the required fixture count for the building.

(2) The accessible water closet shall be located in the corner, diagonal to the door.

11-4.17.4 Toe clearances. In standard stalls, the front partition and at least one side partition shall provide a toe clearance of at least 9 inches (230 mm) above the floor. If the depth of the stall is greater than 60 inches (1525 mm), then the toe clearance is not required.

11-4.17.5 Doors. Toilet stall doors, including door hardware, shall comply with Section 11-4.13. The doors shall be self closing. If toilet stall approach is from latch side of the stall door, clearance between the door side of the stall and any obstruction may be reduced to a minimum of 42 inches (1065 mm) (see Figure 30). Doors shall not swing into the clear floor space of any fixture.

11-4.17.6 Grab bars. Grab bars complying with the length and positioning shown in Figures 30(a), 30(b), 30(c), and 30(d) shall be provided. Grab bars may be mounted with any desired method as long as they have a gripping surface at the locations shown and do not obstruct the required clear floor area. Grab bars shall comply with Section 11-4.26.

11-4.18 Urinals.

11-4.18.1 General. Accessible urinals shall comply with Section 11-4.18.

11-4.18.2 Height. Urinals shall be stall-type or wall-hung with an elongated rim at a maximum of 17 inches (430 mm) above the finish floor.

11-4.18.3 Clear floor space. A clear floor space 30 inches by 48 inches (760 mm by 1220 mm) shall be provided in front of urinals to allow forward approach. This clear space shall adjoin or overlap an accessible route and shall comply with Section 11-4.2.4. Urinal shields that do not extend beyond the front edge of the urinal rim may be provided with 29 inches (735 mm) clearance between them.

11-4.18.4 Flush controls. Flush controls shall be hand operated or automatic, and shall comply with Section 11-4.27.4, and shall be mounted no more than 44 inches (1120 mm) above the finish floor.

11-4.19 Lavatories and mirrors.

11-4.19.1 General. The requirements of Section 11-4.19 shall apply to lavatory fixtures, vanities, and built-in lavatories.

11-4.19.2 Height and clearances. Lavatories shall be mounted with the rim or counter surface no higher than 34 inches (865 mm) above the finish floor. Provide a clearance of at least 29 inches (735 mm) above the finish floor to the bottom of the apron. Knee and toe clearance shall comply with Figure 31.

11-4.19.3 Clear floor space. A clear floor space 30 inches by 48 inches (760 mm by 1219 mm) complying with Section 11-4.2.4 shall be provided in front of a lavatory to allow forward approach. Such clear floor space shall adjoin or overlap an accessible route and shall extend a maximum of 19 inches (485 mm) underneath the lavatory (see Figure 32).

11-4.19.4 Exposed pipes and surfaces. Hot water and drain pipes under lavatories shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories.

11-4.19.5 Faucets. Faucets shall comply with Section 11-4.27.4. Lever-operated, push-type, and electronically controlled mechanisms are examples of acceptable designs. If self-closing valves are used the faucet shall remain open for at least 10 seconds.

11-4.19.6 Mirrors. Mirrors shall be mounted with the bottom edge of the reflecting surface no higher than 40 inches (1015 mm) above the finish floor (see Figure 31).

11-4.20 Bathtubs.

11-4.20.1 General. Accessible bathtubs shall comply with Section 11-4.20.

11-4.20.2 Floor space. Clear floor space in front of bathtubs shall be as shown in Figure 33.

11-4.20.3 Seat. An in-tub seat or a seat at the head end of the tub shall be provided as shown in Figure 33 and Figure 34. The structural strength of seats and their attachments shall comply with Section 11-4.26.3. Seats shall be mounted securely and shall not slip during use.

11-4.20.4 Grab bars. Grab bars complying with Section 11-4.26 shall be provided as shown in Figure 33 and Figure 34.

11-4.20.5 Controls. Faucets and other controls complying with Section 11-4.27.4 shall be located as shown in Figure 34.

11-4.20.6 Shower unit. A shower spray unit with a hose at least 60 inches (1525 mm) long that can be used both as a

fixed shower head and as a hand-held shower shall be provided.

11-4.20.7 Bathtub enclosures. If provided, enclosures for bathtubs shall not obstruct controls or transfer from wheelchairs onto bathtub seats or into tubs. Enclosures on bathtubs shall not have tracks mounted on their rims.

11-4.21 Shower stalls.

11-4.21.1 General. Accessible shower stalls shall comply with Section11-4.21.

11-4.21.2 Size and clearances. Except as specified in Section 11-9.1.2, shower stall size and clear floor space shall comply with Figure 35(a) or Figure 35(b). The shower stall in Figure 35(a) shall be 36 inches by 36 inches (915 mm by 915 mm). Shower stalls required by Section 11-9.1.2 shall comply with Figure 57(a) or Figure 57(b). The shower stall in Figure 35(b) will fit into the space required for a bathtub.

11-4.21.3 Seat. A seat shall be provided in shower stalls 36 inches by 36 inches (915 mm by 915 mm) and shall be as shown in Figure 36. The seat shall be mounted 17 inches to 19 inches (430 mm to 485 mm) from the bathroom floor and shall extend the full depth of the stall. In a 36-inch by 36-inch (915 mm by 915 mm) shower stall, the seat shall be on the wall opposite the controls. Where a fixed seat is provided in a 30-inch by 60-inch minimum (760 mm by 1525 mm) shower stall, it shall be a folding type and shall be mounted on the wall adjacent to the controls as shown in Figure 57. The structural strength of seats and their attachments shall comply with Section 11-4.26.3.

11-4.21.4 Grab bars. Grab bars complying with Section 11-4.26 shall be provided as shown in Figure 37.

11-4.21.5 Controls. Faucets and other controls complying with Section 11-4.27.4 shall be located as shown in Figure 37. In shower stalls 36 inches by 36 inches (915 mm by 915 mm), all controls, faucets, and the shower unit shall be mounted on the side wall opposite the seat.

11-4.21.6 Shower unit. A shower spray unit with a hose at least 60 inches (1525 mm) long that can be used both as a fixed shower head and as a hand-held shower shall be provided.

> **Exception:** In unmonitored facilities where vandalism is a consideration, a fixed shower head mounted at 48 inches (1220 mm) above the shower floor may be used in lieu of a hand-held shower head.

11-4.21.7 Curbs. If provided, curbs in shower stalls 36 inches by 36 inches (915 mm by 915 mm) shall be no higher than $^1/_2$ inch (13 mm). Shower stalls that are 30 inches by 60 inches (760 mm by 1525 mm) minimum shall not have curbs.

11-4.21.8 Shower enclosures. If provided, enclosures for shower stalls shall not obstruct controls or obstruct transfer from wheelchairs onto shower seats.

11-4.22 Toilet rooms.

11-4.22.1 Minimum number. Toilet facilities required to be accessible by Section 11-4.1 shall comply with Section 11-4.22. Accessible toilet rooms shall be on an accessible route.

11-4.22.2 Doors.

(1) All doors to accessible toilet rooms shall comply with Section 11-4.13. Doors shall not swing into the clear floor space required for any fixture.

> **Exception:** All new single-family houses, duplexes, triplexes, condominiums, and townhouses shall provide at least one bathroom, located with maximum possible privacy, where bathrooms are provided on habitable grade levels, with a door that has a 29-inch (737 mm) clear opening. However, if only a toilet room is provided at grade level, such toilet room shall have a clear opening of not less than 29 inches (737 mm).

11-4.22.3 Clear floor space. The accessible fixtures and controls required in Sections 11-4.22.4, 11-4.22.5, 11-4.22.6 and 11-4.22.7 shall be on an accessible route. An unobstructed turning space complying with Section 11-4.2.3 shall be provided within an accessible toilet room. The clear floor space at fixtures and controls, the accessible route, and the turning space may overlap.

11-4.22.4 Water closets. If toilet stalls are provided, then at least one shall be a standard toilet stall complying with Section 11-4.17; where six or more stalls are provided, in addition to the stall complying with Section 11-4.17.3, at least one stall 36 inches (915 mm) wide with an outward swinging, self-closing door and parallel grab bars complying with Figure 30(d) and Section 11-4.26 shall be provided. Water closets in such stalls shall comply with Section 11-4.16. If water closets are not in stalls, then at least one shall comply with Section 11-4.16.

11-4.22.5 Urinals. If urinals are provided, then at least one shall comply with Section 11-4.18.

11-4.22.6 Lavatories and mirrors. If lavatories and mirrors are provided, then at least one of each shall comply with Section 11-4.19.

11-4.22.7 Controls and dispensers. If controls, dispensers, receptacles, or other equipment are provided, then at least one of each shall be on an accessible route and shall comply with Section 11-4.27.

11-4.23 Bathrooms, bathing facilities and shower rooms.

11-4.23.1 Minimum number. Bathrooms, bathing facilities, or shower rooms required to be accessible by Section 11-4.1 shall comply with Section 11-4.23 and shall be on an accessible route.

11-4.23.2 Doors. Doors to accessible bathrooms shall comply with Section 11-4.13. Doors shall not swing into the floor space required for any fixture.

> **Exception:** All new single-family houses, duplexes, triplexes, condominiums, and townhouses shall provide at least one bathroom, located with maximum possible pri-

vacy, where bathrooms are provided on habitable grade levels, with a door that has a 29-inch (737 mm) clear opening. However, if only a toilet room is provided at grade level, such toilet room shall have a clear opening of not less than 29 inches (737 mm).

11-4.23.3 Clear floor space. The accessible fixtures and controls required in Sections 11-4.23.4, 11-4.23.5, 11-4.23.6, 11-4.23.7, 11-4.23.8 and 11-4.23.9 shall be on an accessible route. An unobstructed turning space complying with Section 11-4.2.3 shall be provided within an accessible bathroom. The clear floor spaces at fixtures and controls, the accessible route, and the turning space may overlap.

11-4.23.4 Water closets. If toilet stalls are provided, then at least one shall be a standard toilet stall complying with Section 11-4.17; where six or more stalls are provided, in addition to the stall complying with Section 11-4.17.3, at least one stall 36 inches (915 mm) wide with an outward swinging, self-closing door and parallel grab bars complying with Figure 30(d) and Section 11-4.26 shall be provided. Water closets in such stalls shall comply with Section 11-4.16. If water closets are not in stalls, then at least one shall comply with Section 11-4.16.

11-4.23.5 Urinals. If urinals are provided, then at least one shall comply with Section 11-4.18.

11-4.23.6 Lavatories and mirrors. If lavatories and mirrors are provided, then at least one of each shall comply with Section 11-4.19.

11-4.23.7 Controls and dispensers. If controls, dispensers, receptacles, or other equipment are provided, then at least one of each shall be on an accessible route and shall comply with Section 11-4.27.

11-4.23.8 Bathing and shower facilities. If tubs or showers are provided, then at least one accessible tub that complies with Section 11-4.20 or at least one accessible shower that complies with Section 11-4.21 shall be provided.

11-4.23.9 Medicine cabinets. If medicine cabinets are provided, at least one shall be located with a usable shelf no higher than 44 inches (1120 mm) above the floor space. The floor space shall comply with Section 11-4.2.4.

11-4.24 Sinks.

11-4.24.1 General. Sinks required to be accessible by Section 11-4.1 shall comply with Section 11-4.24.

11-4.24.2 Height. Sinks shall be mounted with the counter or rim no higher than 34 inches (865 mm) above the finish floor.

11-4.24.3 Knee clearance. Knee clearance that is at least 27 inches (685 mm) high, 30 inches (760 mm) wide, and 19 inches (485 mm) deep shall be provided underneath sinks.

11-4.24.4 Depth. Each sink shall be a maximum of $6^1/_2$ inches (165 mm) deep.

11-4.24.5 Clear floor space. A clear floor space at least 30 inches by 48 inches (760 mm by 1219 mm) complying with Section 11-4.2.4 shall be provided in front of a sink to allow forward approach. The clear floor space shall be on an accessible route and shall extend a maximum of 19 inches (485 mm) underneath the sink (see Figure 32).

11-4.24.6 Exposed pipes and surfaces. Hot water and drain pipes exposed under sinks shall be insulated or otherwise configured so as to protect against contact. There shall be no sharp or abrasive surfaces under sinks.

11-4.24.7 Faucets. Faucets shall comply with Section 11-4.27.4. Lever-operated, push-type, touch-type, or electronically controlled mechanisms are acceptable designs.

11-4.25 Storage.

11-4.25.1 General. Fixed storage facilities such as cabinets, shelves, closets, and drawers required to be accessible by Section 11-4.1 shall comply with Section 11-4.25.

11-4.25.2 Clear floor space. A clear floor space at least 30 inches by 48 inches (760 mm by 1219 mm) complying with Section 11-4.2.4 that allows either a forward or parallel approach by a person using a wheelchair shall be provided at accessible storage facilities.

11-4.25.3 Height. Accessible storage spaces shall be within at least one of the reach ranges specified in Section 11-4.2.5 and 11-4.2.6 (see Figure 5 and Figure 6). Clothes rods or shelves shall be a maximum of 54 inches (1370 mm) above the finish floor for a side approach. Where the distance from the wheelchair to the clothes rod or shelf exceeds 10 inches (255 mm) (as in closets without accessible doors) the height and depth to the rod or shelf shall comply with Figure 38(a) and Figure 38(b).

11-4.25.4 Hardware. Hardware for accessible storage facilities shall comply with Section 11-4.27.4. Touch latches and U-shaped pulls are acceptable.

11-4.26 Handrails, grab bars, and tub and shower seats.

11-4.26.1 General. All handrails, grab bars, and tub and shower seats required to be accessible by Section 11-4.1, 11-4.8, 11-4.9, 11-4.16, 11-4.17, 11-4.20 or 11-4.21 shall comply with Section 11-4.26.

11-4.26.2 Size and spacing of grab bars and handrails. The diameter or width of the gripping surfaces of a handrail or grab bar shall be $1^1/_4$ inches to $1^1/_2$ inches (32 mm to 38 mm), or the shape shall provide an equivalent gripping surface. If handrails or grab bars are mounted adjacent to a wall, the space between the wall and the grab bar shall be $1^1/_2$ inches (38 mm) [see Figure 39(a), Figure 39(b), Figure 39(c), and Figure 39(e)]. Handrails may be located in a recess if the recess is a maximum of 3 inches (76 mm) deep and extends at least 18 inches (455 mm) above the top of the rail [see Figure 39(d)].

11-4.26.3 Structural strength. The structural strength of grab bars, tub and shower seats, fasteners and mounting devices shall meet the following specification:

(1) Bending stress in a grab bar or seat induced by the maximum bending moment from the application of

250 lbf (1112 N) shall be less than the allowable stress for the material of the grab bar or seat.

(2) Shear stress induced in a grab bar or seat by the application of 250 lbf (1112 N) shall be less than the allowable shear stress for the material of the grab bar or seat. If the connection between the grab bar or seat and its mounting bracket or other support is considered to be fully restrained, then direct and torsional shear stresses shall be totaled for the combined shear stress, which shall not exceed the allowable shear stress.

(3) Shear force induced in a fastener or mounting device from the application of 250 lbf (1112 N) shall be less than the allowable lateral load of either the fastener or mounting device or the supporting structure, whichever is the smaller allowable load.

(4) Tensile force induced in a fastener by a direct tension force of 250 lbf (1112 N) plus the maximum moment from the application of 250 lbf (1112N) shall be less than the allowable withdrawal load between the fastener and the supporting structure.

(5) Grab bars shall not rotate within their fittings.

11-4.26.4 Eliminating hazards. A handrail or grab bar and any wall or other surface adjacent to it shall be free of any sharp or abrasive elements. Edges shall have a minimum radius of $^1/_8$ inches (3.2 mm).

11-4.27 Controls and operating mechanisms.

11-4.27.1 General. Controls and operating mechanisms required to be accessible by Section 11-4.1 shall comply with Section 11-4.27.

11-4.27.2 Clear floor space. Clear floor space complying with Section 11-4.2.4 that allows a forward or a parallel approach by a person using a wheelchair shall be provided at controls, dispensers, receptacles and other operable equipment.

11-4.27.3 Height. The highest operable part of controls, dispensers, receptacles, and other operable equipment shall be placed within at least one of the reach ranges specified in Sections 11-4.2.5 and 11-4.2.6. Electrical and communications system receptacles on walls shall be mounted no less than 15 inches (380 mm) above the floor.

Exception: These requirements do not apply where the use of special equipment dictates otherwise or where electrical and communications systems receptacles are not normally intended for use by building occupants.

11-4.27.4 Operation. Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls shall be no greater than 5 lbf (22.2 N).

11-4.28 Alarms.

11-4.28.1 General. Alarm systems required to be accessible by Section 11-4.1 shall comply with Section 11-4.28. At a minimum, visual signal appliances shall be provided in buildings and facilities in each of the following areas: restrooms and any other general usage areas (e.g., meeting rooms), hallways, lobbies, and any other area for common use.

11-4.28.2 Audible alarms. If provided, audible emergency alarms shall produce a sound that exceeds the prevailing equivalent sound level in the room or space by at least 15 dbA or exceeds any maximum sound level with a duration of 60 seconds by 5 dbA, whichever is louder. Sound levels for alarm signals shall not exceed 120 dbA.

11-4.28.3 Visual alarms. Visual alarm signal appliances shall be integrated into the building or facility alarm system. If single station audible alarms are provided then single station visual alarm signals shall be provided. Visual alarm signals shall have the following minimum photometric and location features:

(1) The lamp shall be a xenon strobe type or equivalent.

(2) The color shall be clear or nominal white (i.e., unfiltered or clear filtered white light).

(3) The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.

(4) The intensity shall be a minimum of 75 candela.

(5) The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.

(6) The appliance shall be placed 80 inches (2030 mm) above the highest floor level within the space or 6 inches (152 mm) below the ceiling, whichever is lower.

(7) In general, no place in any room or space required to have a visual signal appliance shall be more than 50 feet (15 m) from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 feet (30 m) across, without obstructions 6 feet (2 m) above the finish floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 feet (30 m) apart, in lieu of suspending appliances from the ceiling.

(8) No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 feet (15 m) from the signal.

11-4.28.4 Auxiliary alarms. Units and sleeping accommodations shall have a visual alarm connected to the building emergency alarm system or shall have a standard 110-volt electrical receptacle into which such an alarm can be connected and a means by which a signal from the building emergency alarm system can trigger such an auxiliary alarm. When visual alarms are in place the signal shall be visible in all areas of the unit or room. Instructions for use of the auxiliary alarm or receptacle shall be provided.

11-4.29 Detectable warnings.

11-4.29.1 General. Detectable warnings required by Sections 11-4.1 and 11-4.7 shall comply with 11-4.29.

11-4.29.2 Detectable warnings on walking surfaces.

(1) All detectable warning surfaces required by the code shall be governed by the requirements of ANSI A117.1-1986.

(2) Detectable warning textures on walking surfaces shall consist of exposed aggregate concrete, cushioned surfaces made of rubber or plastic, raised strips, or grooves. Textures shall contrast with that of the surrounding surface. Raised strips or grooves shall comply with Figure 40(a) and Figure 40(b). Grooves may be used indoors only.

11-4.29.3 Detectable warnings on doors to hazardous areas. Reserved.

11-4.29.4 Detectable warnings at stairs. Reserved.

11-4.29.5 Detectable warnings at hazardous vehicular areas. If a walk crosses or adjoins a vehicular way, and the walking surfaces are not separated by curbs, railings, or other elements between the pedestrian areas and vehicular areas, the boundary between the areas shall be defined by a continuous detectable warning which is 36 inches (915 mm) wide, complying with Section 11-4.29.2.

11-4.29.6 Detectable warnings at reflecting pools. The edges of reflecting pools shall be protected by railings, walls, curbs, or detectable warnings complying with Section 11-4.29.2.

11-4.29.7 Standardization. Reserved.

11-4.30 Signage.

11-4.30.1 General. Signage required to be accessible by Section 11-4.1 shall comply with the applicable provisions of Section 11-4.30.

11-4.30.2 Character proportion. Letters and numbers on signs shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10.

11-4.30.3 Character height. Characters and numbers on signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case "X." Lower case characters are permitted.

Height Above Finished Floor	Minimum Character Height
Suspended or Projected Overhead in compliance with Section 11-4.4.2	3 inches (75 mm) minimum

11-4.30.4 Raised and Brailled characters and pictorial symbol signs (pictograms). Letters and numerals shall be raised $^{1}/_{32}$ inches (.8 mm), upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least $^{5}/_{8}$ inches (16 mm) high, but no higher than 2 inches (51 mm). Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 6 inches (152 mm) minimum in height.

11-4.30.5 Finish and contrast. The characters and background of signs shall be eggshell, matte, or other nonglare finish. Characters and symbols shall contrast with their background—either light characters on a dark background or dark characters on a light background.

11-4.30.6 Mounting location and height. Where permanent identification is provided for rooms and spaces, signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60 inches (1525 mm) above the finish floor to the centerline of the sign. Mounting location for such signage shall be so that a person may approach within 3 inches (76 mm) of signage without encountering protruding objects or standing within the swing of a door.

11-4.30.7 Symbols of accessibility.

(1) Facilities and elements required to be identified as accessible by Section 11-4.1 shall use the international symbol of accessibility. The symbol shall be displayed as shown in Figure 43(a) and Figure 43(b).

(2) Volume control telephones. Telephones required to have a volume control by Section 11-4.1.3(17)(b) shall be identified by a sign containing a depiction of a telephone handset with radiating sound waves.

(3) Text telephones. Text telephones required by Section 11-4.1.3(17)(c) shall be identified by the international TDD symbol [see Figure 43(c)]. In addition, if a facility has a public text telephone, directional signage indicating the location of the nearest text telephone shall be placed adjacent to all banks of telephones which do not contain a text telephone. Such directional signage shall include the international TDD symbol. If a facility has no banks of telephones, the directional signage shall be provided at the entrance (e.g., in a building directory).

(4) Assistive listening systems. In assembly areas where permanently installed assistive listening systems are required by Section 11-4.1.3(19)(b) the availability of such systems shall be identified with signage that includes the international symbol of access for hearing loss [Figure 43(d)].

11-4.30.8 Illumination levels. Reserved.

11-4.31 Telephones.

11-4.31.1 General. Public telephones required to be accessible by Section 11-4.1 shall comply with Section 11-4.31.

11-4.31.2 Clear floor or ground space. A clear floor or ground space at least 30 inches by 48 inches (760 mm by 1220 mm) that allows either a forward or parallel approach by a person using a wheelchair shall be provided at telephones (see Figure 44). The clear floor or ground space shall comply with Section 11-4.2.4. Bases, enclosures, and fixed seats shall not impede approaches to telephones by people who use wheelchairs.

11-4.31.3 Mounting height. The highest operable part of the telephone shall be within the reach ranges specified in Section 11-4.2.5 or Section 11-4.2.6.

11-4.31.4 Protruding objects. Telephones shall comply with Section 11-4.4.

11-4.31.5 Hearing aid compatible and volume control telephones required by Section 11-4.1.

(1) Telephones shall be hearing aid compatible.

(2) Volume controls, capable of a minimum of 12 dbA and a maximum of 18 dbA above normal, shall be provided in accordance with Section 11-4.1.3. If an automatic reset is provided then 18 dbA may be exceeded.

11-4.31.6 Controls. Telephones shall have pushbutton controls where service for such equipment is available.

11-4.31.7 Telephone books. Telephone books, if provided, shall be located in a position that complies with the reach ranges specified in Sections 11-4.2.5 and 11-4.2.6.

11-4.31.8 Cord length. The cord from the telephone to the handset shall be at least 29 inches (735 mm) long.

11-4.31.9 Text telephones required by Section 11-4.1.

(1) Text telephones used with a pay telephone shall be permanently affixed within, or adjacent to, the telephone enclosure. If an acoustic coupler is used, the telephone cord shall be sufficiently long to allow connection of the text telephone and the telephone receiver.

(2) Pay telephones designed to accommodate a portable text telephone shall be equipped with a shelf and an electrical outlet within or adjacent to the telephone enclosure. The telephone handset shall be capable of being placed flush on the surface of the shelf. The shelf shall be capable of accommodating a text telephone and shall have 6 inches (152 mm) minimum vertical clearance in the area where the text telephone is to be placed.

(3) Equivalent facilitation may be provided. For example, a portable text telephone may be made available in a hotel at the registration desk if it is available on a 24-hour basis for use with nearby public pay telephones. In this instance, at least one pay telephone shall comply with Paragraph (2) of this section. In addition, if an acoustic coupler is used, the telephone handset cord shall be sufficiently long so as to allow connection of the text telephone and the telephone receiver. Directional signage shall be provided and shall comply with Section 11-4.30.7.

11-4.32 Fixed or built-in seating and tables.

11-4.32.1 Minimum number. Fixed or built-in seating or tables required to be accessible by Section 11-4.1 shall comply with Section 11-4.32.

11-4.32.2 Seating. If seating spaces for people in wheelchairs are provided at fixed tables or counters, clear floor space complying with Section 11-4.2.4 shall be provided. Such clear floor space shall not overlap knee space by more than 19 inches (485 mm) (see Figure 45).

All fixed seating in public food service establishments, in establishments licensed under the Beverage Law for consumption on the premises, and in all other facilities governed by reference Section 11-4.1 shall be designed and constructed in accordance with the following requirements:

(1) All aisles adjacent to fixed seating shall provide clear floor space for wheelchairs.

(2) Where there are open positions along both sides of such aisles, the aisles shall be not less than 52 inches (1321 mm) wide.

11-4.32.3 Knee clearances. If seating for people in wheelchairs is provided at tables or counters, knee spaces at least 27 inches (685 mm) high, 30 inches (760 mm) wide, and 19 inches (485 mm) deep shall be provided (see Figure 45).

11-4.32.4 Height of tables or counters. The tops of accessible tables and counters shall be from 28 inches to 34 inches (710 mm to 865 mm) above the finish floor or ground.

11-4.33 Assembly areas.

11-4.33.1 Minimum number. All public food service establishments, all establishments licensed under the beverage law for consumption on the premises, and assembly and associated areas required to be accessible by Section 11-4.1 shall comply with Section 11-4.33.

11-4.33.2 Size of wheelchair locations. Each wheelchair location shall provide minimum clear ground or floor spaces as shown in Figure 46.

11-4.33.3 Placement of wheelchair locations. Wheelchair areas shall be an integral part of any fixed seating plan and shall be provided so as to provide people with physical disabilities a choice of admission prices and lines of sight comparable to those for members of the general public. They shall adjoin an accessible route that also serves as a means of egress in case of emergency. At least one companion fixed seat shall be provided next to each wheelchair seating area. When the seating capacity exceeds 300, wheelchair spaces shall be provided in more than one location. Readily removable seats may be installed in wheelchair spaces when the spaces are not required to accommodate wheelchair users.

Exception: Accessible viewing positions may be clustered for bleachers, balconies, and other areas having sight lines that require slopes of greater than 5 percent. Equivalent accessible viewing positions may be located on levels having accessible egress.

11-4.33.4 Surfaces. The ground or floor at wheelchair locations shall be level and shall comply with Section 11-4.5.

11-4.33.5 Access to performing areas. An accessible route shall connect wheelchair seating locations with performing areas, including stages, arena floors, dressing rooms, locker rooms, and other spaces used by performers.

11-4.33.6 Placement of listening systems. If the listening system provided serves individual fixed seats, then such seats shall be located within a 50 feet (15 m) viewing distance of the stage or playing area and shall have a complete view of the stage or playing area.

11-4.33.7 Types of listening systems. Assistive listening systems (ALS) are intended to augment standard public address and audio systems by providing signals which can be

received directly by persons with special receivers or their own hearing aids and which eliminate or filter background noise. The type of assistive listening system appropriate for a particular application depends on the characteristics of the setting, the nature of the program, and the intended audience. Magnetic induction loops, infrared and radio frequency systems are types of listening systems which are appropriate for various applications.

11-4.34 Automated teller machines.

11-4.34.1 General. Each automated teller machine required to be accessible by Section 11-4.1.3 shall be on an accessible route and shall comply with Section 11-4.34.

11-4.34.2 Clear floor space. The automated teller machine shall be located so that clear floor space complying with Section 11-4.2.4 is provided to allow a person using a wheelchair to make a forward approach, a parallel approach, or both, to the machine.

11-4.34.3 Reach ranges.

(1) Forward approach only. If only a forward approach is possible, operable parts of all controls shall be placed within the forward reach range specified in Section 11-4.2.5.

(2) Parallel approach only. If only a parallel approach is possible, operable parts of controls shall be placed as follows:

(a) Reach depth not more than 10 inches (255 mm). Where the reach depth to the operable parts of all controls as measured from the vertical plane perpendicular to the edge of the unobstructed clear floor space at the farthest protrusion of the automated teller machine or surround is not more than 10 inches (255 mm), the maximum height above the finish floor or grade shall be 54 inches (1370 mm).

(b) Reach depth more than 10 inches (255 mm). Where the reach depth to the operable parts of any control as measured from the vertical plane perpendicular to the edge of the unobstructed clear floor space at the farthest protrusion of the automated teller machine or surround is more than 10 inches (255 mm), the maximum height above the finish floor or grade shall be as follows:

Reach Depth		Maximum Height	
In	mm	In	mm
10	255	54	1370
11	280	53 1/2	1360
12	305	53	1345
13	330	52 1/2	1335
14	355	51 1/2	1310
15	380	51	1295
16	405	50 1/2	1285
17	430	50	1270
18	455	49 1/2	1255
19	485	49	1245
20	510	48 1/2	1230
21	535	47 1/2	1205
22	560	47	1195
23	585	46 1/2	1180
24	610	46	1170

(3) Forward and parallel approach. If both a forward and parallel approach are possible, operable parts of controls shall be placed within at least one of the reach ranges in paragraphs Section 11-4.34.3(1) or Section 11-4.34.3(2) of this section.

(4) Bins. Where bins are provided, for envelopes, waste paper, or other purposes, at least one of each type provided shall comply with the applicable reach ranges in paragraph Section 11-4.34.3(1), 11-4.34.3(2) or 11-4.34.3(3) of this section.

Exception: Where a function can be performed in a substantially equivalent manner by using an alternate control, only one of the controls needed to perform that function is required to comply with this section. If the controls are identified by tactile markings, such markings shall be provided on both controls.

11-4.34.4 Controls. Controls for user activation shall comply with Section 11-4.27.4.

11-4.34.5 Equipment for persons with vision impairments. Instructions and all information for use shall be made accessible to and independently usable by persons with vision impairments.

11-4.35 Dressing and fitting rooms.

11-4.35.1 General. Dressing and fitting rooms required to be accessible by Section 11-4.1 shall comply with Section 11-4.35 and shall be on an accessible route.

11-4.35.2 Clear floor space. A clear floor space allowing a person using a wheelchair to make a 180-degree turn shall be provided in every accessible dressing room entered through a swinging or sliding door. No door shall swing into any part of the turning space. Turning space shall not be required in a private dressing room entered through a curtained opening at least 32 inches (815 mm) wide if clear floor space complying with Section 11-4.2 renders the dressing room usable by a person using a wheelchair.

11-4.35.3 Doors. All doors to accessible dressing rooms shall be in compliance with Section 11-4.13.

11-4.35.4 Bench. Every accessible dressing room shall have a 24 inches by 48 inches (610 mm by 1219 mm) bench fixed to the wall along the longer dimension. The bench shall be mounted 17 inches to 19 inches (430 mm to 485 mm) above the finish floor. Clear floor space shall be provided alongside the bench to allow a person using a wheelchair to make a parallel transfer onto the bench. The structural strength of the bench and attachments shall comply with Section 11-4.26.3. Where installed in conjunction with showers, swimming pools, or other wet locations, water shall not accumulate upon the surface of the bench and the bench shall have a slip-resistant surface.

11-4.35.5 Mirror. Where mirrors are provided in dressing rooms of the same use, then in an accessible dressing room, a full-length mirror, measuring at least 18 inches wide by 54 inches high (460 mm by 1370 mm), shall be mounted in a position affording a view to a person on the bench as well as to a person in a standing position.

SECTION 11-5
RESTAURANTS AND CAFETERIAS

11-5.1 General. Except as specified or modified in this section, restaurants and cafeterias shall comply with the requirements of Section 11-4.1 to Section 11-4.35. Where fixed tables (or dining counters where food is consumed but there is no service) are provided, at least 5 percent, but not less than one, of the fixed tables (or a portion of the dining counter) shall be accessible and shall comply with Section 11-4.32 as required in Section 11-4.1.3(18). In establishments where separate areas are designated for smoking and nonsmoking patrons, the required number of accessible fixed tables (or counters) shall be proportionally distributed between the smoking and nonsmoking areas. In new construction, and where practicable in alterations, accessible fixed tables (or counters) shall be distributed throughout the space or facility.

11-5.2 Counters and bars. Where food or drink is served at counters exceeding 34 inches (865 mm) in height for consumption by customers seated on stools or standing at the counter, a portion of the main counter which is 60 inches (1525 mm) in length minimum shall be provided in compliance with Section 11-4.32 or service shall be available at accessible tables within the same area.

11-5.3 Access aisles. All accessible fixed tables shall be accessible by means of an access aisle at least 36 inches (915 mm) clear between parallel edges of tables or between a wall and the table edges.

11-5.4 Dining areas. In new construction, all dining areas, including raised or sunken dining areas, loggias, and outdoor seating areas, shall be accessible. In alterations, accessibility to raised or sunken dining areas, or to all parts of outdoor seating areas is not required provided that the same services and decor are provided in an accessible space usable by the general public and are not restricted to use by people with disabilities.

Exception: Nothing in this section shall be construed to relieve the owner of the duty to provide vertical accessibility to all levels above and below occupiable grade level, regardless of whether the code requires an elevator to be installed in such buildings, structures or facilities except: (1) elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks, and automobile lubrication and maintenance pits and platforms; (2) unoccupiable spaces, such as rooms, enclosed spaces, and storage spaces that are not designed for human occupancy, for public accommodations, or for work areas; and (3) occupiable spaces and rooms that are not open to the public and that house no more than five persons including, but not limited to, equipment control rooms and projection booths. Therefore, facilities subject to the ADA may be required to provide vertical access to areas otherwise exempt under Section 11-4.1.3(5), of the code.

11-5.5 Food service lines. Food service lines shall have a minimum clear width of 36 inches (915 mm), with a preferred clear width of 42 inches (1065 mm) to allow passage around a person using a wheelchair. Tray slides shall be mounted no higher than 34 inches (865 mm) above the floor (see Figure 53). If self-service shelves are provided, at least 50 percent of each type must be within reach ranges specified in Sections 11-4.2.5 and 11-4.2.6.

11-5.6 Tableware and condiment areas. Self-service shelves and dispensing devices for tableware, dishware, condiments, food and beverages shall be installed to comply with Section 11-4.2 (see Figure 54).

11-5.7 Raised platforms. In banquet rooms or spaces where a head table or speaker's lectern is located on a raised platform, the platform shall be accessible in compliance with Section 11-4.8 or Section 11-4.11. Open edges of a raised platform shall be protected by placement of tables or by a curb.

11-5.8 Vending machines and other equipment. Spaces for vending machines and other equipment shall comply with Section 11-4.2 and shall be located on an accessible route.

11-5.9 Quiet areas. Reserved.

SECTION 11-6
MEDICAL CARE FACILITIES

11-6.1 General. Medical care facilities included in this section are those in which people receive physical or medical treatment or care and where persons may need assistance in responding to an emergency and where the period of stay may exceed 24 hours. In addition to the requirements of Sections 11-4.1 through 11-4.35, medical care facilities and buildings shall comply with Section 11-6.

(1) Hospitals–general purpose hospitals, psychiatric facilities, detoxification facilities. At least 10 percent of patient bedrooms and toilets and all public use and common use areas are required to be designed and constructed to be accessible.

(2) Hospitals and rehabilitation facilities that specialize in treating conditions that affect mobility, or units within either that specialize in treating conditions that affect mobility. All patient bedrooms and toilets, and all public use and common use areas are required to be designed and constructed to be accessible.

(3) Long-term care facilities and nursing homes. At least 50 percent of patient bedrooms and toilets, and all public use and common use areas are required to be designed and constructed to be accessible.

(4) Alterations to patient bedrooms.

(a) When patient bedrooms are being added or altered as part of a planned renovation of an entire wing, a department, or other discrete area of an existing medical facility, a percentage of the patient bedrooms that are being added or altered shall comply with Section 11-6.3. The percentage of accessible rooms provided shall be consistent with the percentage of rooms required to be accessible by the applicable requirements of Sections 11-6.1(1), 11-6.1(2), or 11-6.1(3), until the number of accessible patient bedrooms in the facility equals the overall number that would be required if the facility were newly constructed. (For example, if 20 patient bedrooms are being altered in the obstetrics department of a hospital, two of the altered rooms must be made accessible. If, within the same hospital, 20 patient bedrooms are being altered in a unit that specializes in treating mobility impairments, all of the altered rooms must be made accessible.) Where toilet/bathrooms are part of patient bedrooms which are added or altered and required to be accessible, each such patient toilet/bathroom shall comply with Section 11-6.4.

(b) When patient bedrooms are being added or altered individually, and not as part of an alteration of the entire area, the altered patient bedrooms shall comply with Section 11-6.3, unless either: (a) the number of accessible rooms provided in the department or area containing the altered patient bedroom equals the number of accessible patient bedrooms that would be required if the percentage requirements of Section 11-6.1(1), 11-6.1(2), or 11-6.1(3) were applied to that department or area; or (b) the number of accessible patient bedrooms in the facility equals the overall number that would be required if the facility were newly constructed. Where toilet/bathrooms are part of patient bedrooms which are added or altered and required to be accessible, each such toilet/bathroom shall comply with Section 11-6.4.

11-6.2 Entrances. At least one accessible entrance that complies with Section 11-4.14 shall be protected from the weather by canopy or roof overhang. Such entrances shall incorporate a passenger loading zone that complies with Section 11-4.6.6.

11-6.3 Patient bedrooms. Provide accessible patient bedrooms in compliance with Section 11-4.1 through Section 11-4.35. Accessible patient bedrooms shall comply with the following:

(1) Each bedroom shall have a door that complies with Section 11-4.13.

Exceptions: Entry doors to acute care hospital bedrooms for in-patients shall be exempted from the requirement in Section 11-4.13.6 for maneuvering space at the latch side of the door if the door is at least 44 inches (1120 mm) wide.

(2) Each bedroom shall have adequate space to provide a maneuvering space that complies with Section 11-4.2.3. In rooms with two beds, it is preferable that this space be located between beds.

(3) Each bedroom shall have adequate space to provide a minimum clear floor space of 36 inches (915 mm) along each side of the bed and to provide an accessible route complying with Section 11-4.3.3 to each side of each bed.

11-6.4 Patient toilet rooms. Where toilet/bath rooms are provided as a part of a patient bedroom, each patient bedroom that is required to be accessible shall have an accessible toilet/bath room that complies with Section 11-4.22 or 11-4.23 and shall be on an accessible route.

SECTION 11-7
BUSINESS AND MERCANTILE

11-7.1 General. In addition to the requirements of Sections 11-4.1 to 11-4.35, the design of all areas used for business transactions with the public shall comply with Section 11-7.

11-7.2 Sales and service counters, teller windows, information counters.

(1) In department stores and miscellaneous retail stores where counters have cash registers and are provided for sales or distribution of goods or services to the public, at least one of each type shall have a portion of the counter which is at least 36 inches (915 mm) in length with a maximum height of 36 inches (915 mm) above the finish floor. It shall be on an accessible route complying with Section 11-4.3. The accessible counters must be dispersed throughout the building or facility. In alterations where it is technically infeasible to provide an accessible counter, an auxiliary counter meeting these requirements may be provided.

(2) At ticketing counters, teller stations in a bank, registration counters in hotels and motels, box office ticket counters, and other counters that may not have a cash register but at which goods or services are sold or distributed, either:

(i) A portion of the main counter which is a minimum of 36 inches (915 mm) in length shall be provided with a maximum height of 36 inches (915 mm); or

(ii) An auxiliary counter with a maximum height of 36 in (915 mm) in close proximity to the main counter shall be provided; or

(iii) Equivalent facilitation shall be provided (e.g., at a hotel registration counter, equivalent facilitation might consist of:

(1) Provision of a folding shelf attached to the main counter on which an individual with disabilities can write, and

(2) Use of the space on the side of the counter or at the concierge desk, for handing materials back and forth).

All accessible sales and service counters shall be on an accessible route complying with Section 11-4.3.

(3) **Assistive listening devices.** Reserved.

11-7.3 Check-out aisles.

(1) In new construction, accessible check-out aisles shall be provided in conformance with the table below:

Total Check-out Aisles of Each Design	Minimum Number of Accessible Check-out Aisles of Each Design
1 - 4	1
5 - 8	2
8 - 15	3
Over 15	3, plus 20% of additional aisles

Exception:

1. In new construction, where the selling space is under 5,000 square feet (465 m^2), only one check-out aisle is required to be accessible.
2. In alterations, at least one check-out aisle shall be accessible in facilities under 5,000 square feet (465 m^2) of selling space. In facilities of 5,000 or more square feet (465 m^2) of selling space, at least one of each design of check-out aisle shall be made accessible when altered until the number of accessible check-out aisles of each design equals the number required in new construction.

Examples of check-out aisles of different "design" include those which are specifically designed to serve different functions. Different "design" includes but is not limited to the following features length of belt or no belt; or permanent signage designating the aisle as an express lane.

(2) Clear aisle width for accessible check-out aisles shall comply with Section 11-4.2.1 and maximum adjoining counter height shall not exceed 38 inches (965 mm) above the finish floor. The top of the lip shall not exceed 40 inches (1015 mm) above the finish floor.

(3) Signage identifying accessible check-out aisles shall comply with Section 11-4.30.7 and shall be mounted above the check-out aisle in the same location where the check-out number or type of check-out is displayed.

(4) All customer checkout aisles not required by this code to be accessible shall have at least 32 inches (813 mm) of clear passage.

11-7.4 Security bollards. Any device used to prevent the removal of shopping carts from store premises shall not prevent access or egress to people in wheelchairs. An alternate entry that is equally convenient to that provided for the ambulatory population is acceptable.

SECTION 11-8
LIBRARIES

11-8.1 General. In addition to the requirements of Sections 11-4.1 to 11-4.35, the design of all public areas of a library shall comply with Section 11-8, including reading and study areas, stacks, reference rooms, reserve areas, and special facilities or collections.

11-8.2 Reading and study areas. At least 5 percent or a minimum of one of each element of fixed seating, tables, or study carrels shall comply with Sections 11-4.2 and 11-4.32. Clearances between fixed accessible tables and between study carrels shall comply with Section 11-4.3.

11-8.3 Check-out areas. At least one lane at each check-out area shall comply with Section 11-7.2(1). Any traffic control or book security gates or turnstiles shall comply with Section 11-4.13.

11-8.4 Card catalogs and magazine displays. Minimum clear aisle space at card catalogs and magazine displays shall comply with Figure 55. Maximum reach height shall comply with Section 11-4.2, with a height of 48 inches (1219 mm) preferred irrespective of approach allowed.

11-8.5 Stacks. Minimum clear aisle width between stacks shall comply with Section 11-4.3, with a minimum clear aisle width of 42 inches (1065 mm) preferred where possible. Shelf height in stack areas is unrestricted (see Figure 56).

SECTION 11-9
ACCESSIBLE TRANSIENT LODGING

(1) Except as specified in the special technical provisions of this section, accessible transient lodging shall comply with the applicable requirements of Sections 11-4.1 through 11-4.35. Transient lodging includes facilities or portions thereof used for sleeping accommodations, when not classed as a medical care facility.

11-9.1 Hotels, motels, inns, boarding houses, dormitories, resorts and other similar places of transient lodging.

11-9.1.1 General. All public use and common use areas are required to be designed and constructed to comply with Section 11-4.

Exception: Sections 11-9.1 to 11-9.4 do not apply to an establishment located within a building that contains not more than five rooms for rent or hire and that is actually occupied by the proprietor of such establishment as the residence of such proprietor.

11-9.1.2 Accessible units, sleeping rooms, and suites. Accessible sleeping rooms or suites that comply with the requirements of Sections 11-9.2.1 to 11-9.2 shall be provided in conformance with the table below. In addition, in hotels, of 50 or more sleeping rooms or suites, additional accessible sleeping rooms or suites that include a roll-in shower shall also be provided in conformance with the table below. Such accommodations shall comply with the requirements of Sections 11-9.2, and 11-4.21, and Figure 57(a) or 57(b).

In all buildings, structures and facilities licensed as a hotel, motel or "resort condominium" pursuant to Chapter 509, *Florida Statutes*, a number of rooms equaling at least 5 percent of the guest rooms minus the number of Accessible rooms required by the table below shall provide the additional special accessibility features of Section 11-9.2.3.

11-9.1.3 Sleeping accommodations for persons with hearing impairments. In addition to those accessible sleeping rooms and suites required by Section 11-9.1.2, sleeping rooms and suites that comply with Section 11-9.3 shall be provided in conformance with the following table:

Number of Elements	Accessible Elements
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2% of total
1001 and over	20 plus 1 for each 100 over 1000

11-9.1.4 Classes of sleeping accommodations.

(1) In order to provide persons with disabilities a range of options equivalent to those available to other persons served by the facility, sleeping rooms and suites required to be accessible by Section 11-9.1.2 shall be dispersed among the various classes of sleeping accommodations available to patrons of the place of transient lodging. Factors to be considered include room size, cost, amenities provided, and the number of beds provided.

(2) Equivalent facilitation. For purposes of this section, it shall be deemed equivalent facilitation if the operator of a facility elects to limit construction of accessible rooms to those intended for multiple occupancy, provided that such rooms are made available at the cost of a single occupancy room to an individual with disabilities who requests a single-occupancy room.

11-9.1.5 Alterations to accessible units, sleeping rooms, and suites. When sleeping rooms are being altered in an existing facility, or portion thereof, subject to the requirements of this section, at least one sleeping room or suite that complies with the requirements of Section 11-9.2 shall be provided for each of the 25 sleeping rooms, or fraction thereof, of rooms being altered until the number of such rooms provided equals the number required to be accessible with Section 11-9.1.2. In addition, at least one sleeping room or suite that complies with the requirements of Section 11-9.3 shall be provided for each of the 25 sleeping rooms, or fraction thereof, of rooms being altered until the number of such rooms equals the number required to be accessible by Section 11-9.1.3.

11-9.2 Requirements for accessible units, sleeping rooms and suites.

11-9.2.1 General. Units, sleeping rooms, and suites required to be accessible by Section 11-9.1 shall comply with Section 11-9.2.

11-9.2.2 Minimum requirements. An accessible unit, sleeping room or suite shall be on an accessible route complying with Section 11-4.3 and have the following accessible elements and spaces.

(1) Accessible sleeping rooms shall have a 36 inch (915 mm) clear width maneuvering space located along both sides of a bed, except that where two beds are provided, this requirement can be met by providing a 36 inches (915 mm) wide maneuvering space located between the two beds.

(2) An accessible route complying with Section 11-4.3 shall connect all accessible spaces and elements, including telephones, within the unit, sleeping room, or

Number of Rooms	Accessible Rooms	Rooms with Roll-in Showers	Florida 5%
1 to 25	1		
26 to 50	2		
51 to 75	3	1	
76 to 100	4	1	
101 to 150	5	2	(See second paragraph of Section 11-9.1.2)
151 to 200	6	2	
201 to 300	7	3	
301 to 400	8	4	
401 to 500	9	4, plus one for each additional 100 over 400	
501 to 1000	2% of total		
1001 and over	20 plus 1 for each 100 over 1000		

suite. This is not intended to require an elevator in multistory units as long as the spaces identified in Sections 11-9.2.2(6) and 11-9.2.2(7) are on accessible levels and the accessible sleeping area is suitable for dual occupancy.

(3) Doors and doorways designed to allow passage into and within all sleeping rooms, suites or other covered units shall comply with Section 11-4.13.

(4) If fixed or built-in storage facilities such as cabinets, shelves, closets, and drawers are provided in accessible spaces, at least one of each type provided shall contain storage space complying with Section 11-4.25. Additional storage may be provided outside of the dimensions required by Section 11-4.25.

(5) All controls in accessible units, sleeping rooms, and suites shall comply with Section 11-4.27.

(6) Where provided as part of an accessible unit, sleeping room, or suite, the following spaces shall be accessible and shall be on an accessible route:

(a) The living area.

(b) The dining area.

(c) At least one sleeping area.

(d) Patios, terraces, or balconies.

Exception: The requirements of Sections 11-4.13.8 and 11-4.3.8 do not apply where it is necessary to utilize a higher door threshold or a change in level to protect the integrity of the unit from wind/water damage. Where this exception results in patios, terraces or balconies that are not at an accessible level, equivalent facilitation shall be provided. (e.g., equivalent facilitation at a hotel patio or balcony might consist of providing raised decking or a ramp to provide accessibility).

(e) At least one full bathroom (i.e., one with a water closet, a lavatory, and a bathtub or shower).

(f) If only half baths are provided, at least one-half bath.

(g) Carports, garages or parking spaces.

(7) Kitchens, kitchenettes or wet bars: When provided as accessory to a sleeping room or suite, kitchens, kitchenettes, wet bars, or similar amenities shall be accessible. Clear floor space for a front or parallel approach to cabinets, counters, sinks, and appliances shall be provided to comply with Section 11-4.2.4. Countertops and sinks shall be mounted at a maximum height of 34 inches (865 mm) above the floor. At least 50 percent of shelf space in cabinets or refrigerator/freezers shall be within the reach ranges of Section 11-4.2.5 or 11-4.2.6 and space shall be designed to allow for the operation of cabinet and/or appliance doors so that all cabinets and appliances are accessible and usable. Controls and operating mechanisms shall comply with Section 11-4.27.

(8) Sleeping room accommodations for persons with hearing impairments required by Section 11-9.1 and complying with Section 11-9.3 shall be provided in the accessible sleeping room or suite.

11-9.2.3 Hotel, motel and condominium special accessibility feature. Nothing in this section shall be construed as relieving the owner of the responsibility of providing accessible rooms in conformance with Sections 11-9.1 and 11-9.5 of the code.

In all buildings, structures and facilities licensed as a hotel, motel or resort condominium pursuant to Chapter 509, *Florida Statutes*, a number of rooms equaling at least 5 percent of the guest rooms minus the number of accessible rooms required by the table in Section 11-9.1.2 shall provide the following additional special accessibility features:

(1) Grab rails in bathrooms and toilet rooms which comply with Section 11-4.16.4 of this code.

(2) All beds in designed accessible guest rooms shall be open-frame type to permit passage of lift devices.

(3) All standard water closet seats shall be at a height of 15 inches (381 mm), measured vertically from the finish floor to the top of the seat, with a variation of plus or minus $^1/_2$ inch (12.7 mm). A portable or attached raised toilet seat shall be provided in all designated permanent disability accessible rooms.

11-9.3 Visual alarms, notification devices and telephones.

11-9.3.1 General. In sleeping rooms required to comply with this section, auxiliary visual alarms shall be provided and shall comply with Section 11-4.28.4. Visual notification devices shall also be provided in units, sleeping rooms and suites to alert room occupants of incoming telephone calls and a door knock or bell.

Notification devices shall not be connected to auxiliary visual alarm signal appliances. Permanently installed telephones shall have volume controls complying with Section 11-4.31.5; an accessible electrical outlet within 4 feet (1219 mm) of a telephone connection shall be provided to facilitate the use of a text telephone.

11-9.3.2 Equivalent facilitation. For purposes of this section, equivalent facilitation shall include the installation of electrical outlets (including outlets connected to a facility's central alarm system) and telephone wiring in sleeping rooms and suites to enable persons with hearing impairments to utilize portable visual alarms and communication devices provided by the operator of the facility.

11-9.4 Other sleeping rooms and suites. Doors and doorways designed to allow passage into and within all sleeping units or other covered units shall comply with Section 11-4.13.5.

11-9.5 Transient lodging in homeless shelters, halfway houses, transient group homes, and other social service establishments.

11-9.5.1 New construction. In new construction all public use and common use areas are required to be designed and constructed to comply with Section 11-4. At least

one of each type of amenity (such as washers, dryers and similar equipment installed for the use of occupants) in each common area shall be accessible and shall be located on an accessible route to any accessible unit or sleeping accommodation.

Exception: Where elevators are not provided as allowed in Section 11-4.13(5), accessible amenities are not required on inaccessible floors as long as one of each type is provided in common areas on accessible floors.

11-9.5.2 Alterations.

(1) Social service establishments which are not homeless shelters:

(a) The provisions of Sections 11-9.5.3 and 11-9.1.5 shall apply to sleeping rooms and beds.

(b) Alteration of other areas shall be consistent with the new construction provisions of Section 11-9.5.1.

(2) Homeless shelters. If the following elements are altered, the following requirements apply:

(a) At least one public entrance shall allow a person with mobility impairments to approach, enter and exit including a minimum clear door width of 32 inches (813 mm).

(b) Sleeping space for homeless persons as provided in the scoping provisions of Section 11-9.1.2 shall include doors to the sleeping area with a minimum clear width of 32 inches (813 mm) and maneuvering space around the beds for persons with mobility impairments complying with Section 11-9.2.2(1).

(c) At least one toilet room for each gender or one unisex toilet room shall have a minimum clear door width of 32 inches (813 mm), minimum turning space complying with Section 11-4.2.3, one water closet complying with Section 11-4.16, one lavatory complying with Section 11-4.19 and the door shall have a privacy latch; and, if provided, at least one tub or shower shall comply with Section 11-4.20 or 11-4.21, respectively.

(d) At least one common area which a person with mobility impairments can approach, enter and exit including a minimum clear door width of 32 inches (813 mm).

(e) At least one route connecting elements Sections 11-9.5.2(2)(a), 11-9.5.2(2)(b), 11-9.5.2(2)(c), 11-9.5.2(2)(d), which a person with mobility impairments can use, including minimum clear width of 36 inches (914 mm), passing space complying with Section 11-4.3.4, turning space complying with Section 11-4.2.3 and changes in levels complying with Section 11-4.3.8.

(f) Homeless shelters can comply with the provisions of Sections 11-9.5.2(2)(a) through 11-9.5.2(2)(e) by providing the above elements on one accessible floor.

11-9.5.3 Accessible sleeping accommodations in new construction. Accessible sleeping rooms shall be provided in conformance with the table in Section 11-9.1.2 and shall comply with Section 11-9.2 (where the items are provided). Additional sleeping rooms that comply with Section 11-9.3 shall be provided in conformance with the table provided in Section 11-9.1.3.

In facilities with multibed rooms or spaces, a percentage of the beds equal to the table provided in Section 11-9.1.2 shall comply with Section 11-9.2.2(1).

SECTION 11-10
TRANSPORTATION FACILITIES

11-10.1 General. Every station, bus stop, bus stop pad, terminal, building or other transportation facility, shall comply with the applicable provisions of Sections 11-4.1 through 11-4.35, Sections 11-5 through 11-9, and the applicable provisions of this section. The exceptions for elevators in Section 11-4.1.3(5), Exception 1 and Section 11-4.1.6(1)(k) do not apply to a terminal, depot, or other station used for specified public transportation, or an airport passenger terminal, or facilities subject to Title II.

11-10.2 Bus stops and terminals.

11-10.2.1 New construction.

(1) Where new bus stop pads are constructed at bus stops, bays or other areas where a lift or ramp is to be deployed, they shall have a firm, stable surface; a minimum clear length of 96 inches (2438 mm) (measured from the curb or vehicle roadway edge) and minimum clear width of 60 inches (1524 mm) (measured parallel to the vehicle roadway) to the maximum extent allowed by legal or site constraints; and shall be connected to streets, sidewalks or pedestrian paths by an accessible route complying with Sections 11-4.3 and 11-4.4. The slope of the pad parallel to the roadway shall, to the extent practicable, be the same as the roadway. For water drainage, a maximum slope of 1:50 (2 percent) perpendicular to the roadway is allowed.

(2) Where provided, new or replaced bus shelters shall be installed or positioned so as to permit a wheelchair or mobility aid user to enter from the public way and to reach a location, having a minimum clear floor area of 30 inches by 48 inches (762 mm by 1219 mm), entirely within the perimeter of the shelter. Such shelters shall be connected by an accessible route to the boarding area provided under paragraph Section 11-10.2.1(1) of this section.

(3) Where provided, all new bus route identification signs shall comply with Section 11-4.30.5. In addition, to the maximum extent practicable, all new bus route identification signs shall comply with Sections

11-4.30.2 and 11-4.30.3. Signs that are sized to the maximum dimensions permitted under legitimate local, state or federal regulations or ordinances shall be considered in compliance with Sections 11-4.30.2 and 11-4.30.3 for purposes of this section.

Exception: Bus schedules, timetables, or maps that are posted at the bus stop or bus bay are not required to comply with this provision.

11-10.2.2 Bus stop siting and alterations.

(1) Bus stop sites shall be chosen such that, to the maximum extent practicable, the areas where lifts or ramps are to be deployed comply with Sections 11-10.2.1(1) and 11-10.2.1(2).

(2) When new bus route identification signs are installed or old signs are replaced, they shall comply with the requirements of Section 11-10.2.1(3).

11-10.3 Fixed facilities and stations.

11-10.3.1 New construction. New stations in rapid rail, light rail, commuter rail, intercity bus, intercity rail, high-speed rail, and other fixed guideway systems (e.g., automated guideway transit, monorails, etc.) shall comply with the following provisions, as applicable:

(1) Elements such as ramps, elevators or other circulation devices, fare vending or other ticketing areas, and fare collection areas shall be placed to minimize the distance which wheelchair users and other persons who cannot negotiate steps may have to travel compared to the general public. The circulation path, including an accessible entrance and an accessible route, for persons with disabilities shall, to the maximum extent practicable, coincide with the circulation path for the general public. Where the circulation path is different, signage complying with Sections 11-4.30.1, 11-4.30.2, 11-4.30.3, 11-4.30.5, and 11-4.30.7(1) shall be provided to indicate direction to and identify the accessible entrance and accessible route.

(2) In lieu of compliance with Section 11-4.1.3(8), at least one entrance to each station shall comply with Section 11-4.14. If different entrances to a station serve different transportation fixed routes or groups of fixed routes, at least one entrance serving each group or route shall comply with Section 11-4.14. All accessible entrances shall, to the maximum extent practicable, coincide with those used by the majority of the general public.

(3) Direct connections to commercial, retail, or residential facilities shall have an accessible route complying with Section 11-4.3 from the point of connection to boarding platforms and all transportation system elements used by the public. Any elements provided to facilitate future direct connections shall be on an accessible route connecting boarding platforms and all transportation system elements used by the public.

(4) Where signs are provided at entrances to stations identifying the station or the entrance, or both, at least one sign and entrance shall comply with Sections 11-4.30.4 and 11-4.30.6. Such signs shall be placed in uniform locations at entrances within the transit system to the maximum extent practicable.

Exception: Where the station has no defined entrance, but signage is provided, then the accessible signage shall be placed in a central location.

(5) Stations covered by this section shall have identification signs complying with Sections 11-4.30.1, 11-4.30.2, 11-4.30.3, and 11-4.30.5. Signs shall be placed at frequent intervals and shall be clearly visible from within the vehicle on both sides when not obstructed by another train When station identification signs are placed close to vehicle windows (i.e., on the side opposite from boarding) each shall have the top of the highest letter or symbol below the top of the vehicle window and the bottom of the lowest letter or symbol above the horizontal midline of the vehicle window.

(6) Lists of stations, routes, or destinations served by the station and located on boarding areas, platforms, or mezzanines shall comply with Sections 11-4.30.1, 11-4.30.2, 11-4.30.3, and 11-4.30.5. A minimum of one sign identifying the specific station and complying with Sections 11-4.30.4 and 11-4.30.6 shall be provided on each platform or boarding area. All signs referenced in this paragraph shall, to the maximum extent practicable, be placed in uniform locations within the transit system.

(7) Automatic fare vending, collection and adjustment (e.g., add-fare) systems shall comply with Sections 11-4.34.2, 11-4.34.3, 11-4.34.4, and 11-4.34.5. At each accessible entrance such devices shall be located on an accessible route. If self-service fare collection devices are provided for the use of the general public, at least one accessible device for entering, and at least one for exiting, unless one device serves both functions, shall be provided at each accessible point of entry or exit. Accessible fare collection devices shall have a minimum clear opening width of 32 inches (813 mm); shall permit passage of a wheelchair; and, where provided, coin or card slots and controls necessary for operation shall comply with Section 11-4.27. Gates which must be pushed open by wheelchair or mobility aid users shall have a smooth continuous surface extending from 2 inches (51 mm) above the floor to 27 inches (686 mm) above the floor and shall comply with Section 11-4.13. Where the circulation path does not coincide with that used by the general public, accessible fare collection systems shall be located at or adjacent to the accessible point of entry or exit.

(8) Platform edges bordering a drop-off and not protected by platform screens or guard rails shall have a detectable warning. Such detectable warnings shall comply with Section 11-4.29.2 and shall be 24 inches (610 mm) wide running the full length of the platform drop-off.

(9) In stations covered by this section, rail-to-platform height in new stations shall be coordinated with the floor height of new vehicles so that the vertical difference, measured when the vehicle is at rest, is within plus or minus $^5/_8$ inch (16 mm) under normal passenger load conditions. For rapid rail, light rail, commuter rail, high speed rail, and intercity rail systems in new stations, the horizontal gap, measured when the new vehicle is at rest, shall be no greater than 3 inches (76 mm). For slow-moving automated guideway "people mover" transit systems, the horizontal gap in new stations shall be no greater than 1 inch (25 mm).

Exceptions:

1. Existing vehicles operating in new stations may have a vertical difference with respect to the new platform within plus or minus $1^1/_2$ inch (38 mm).
2. In light rail, commuter rail and intercity rail systems where it is not operationally or structurally feasible to meet the horizontal gap or vertical difference requirements, minihigh platforms, car-borne or platform-mounted lifts, ramps or bridge plates, or similar manually deployed devices, meeting the applicable requirements of 36 C.F.R. Part 1192, or 49 C.F.R. Part 38 shall suffice.

(10) Stations shall not be designed or constructed so as to require persons with disabilities to board or alight from a vehicle at a location other than one used by the general public.

(11) Illumination levels in the areas where signage is located shall be uniform and shall minimize glare on signs. Lighting along circulation routes shall be of a type and configuration to provide uniform illumination.

(12) Text telephones: The following shall be provided in accordance with Section 11-4.31.9:

(a) If an interior public pay telephone is provided in a transit facility (as defined by the Department of Transportation) at least one interior public text telephone shall be provided in the station.

(b) Where four or more public pay telephones serve a particular entrance to a rail station and at least one is in an interior location, at least one interior public text telephone shall be provided to serve that entrance. Compliance with this section constitutes compliance with Section 11-4.1.3(17)(c).

(13) Where it is necessary to cross tracks to reach boarding platforms, the route surface shall be level and flush with the rail top at the outer edge and between rails, except for a maximum $2^1/_2$-inch (64 mm) gap on the inner edge of each rail to permit passage of wheel flanges. Such crossings shall comply with Section 11-4.29.5. Where gap reduction is not practicable, an above-grade or below-grade accessible route shall be provided.

(14) Where public address systems are provided to convey information to the public in terminals, stations, or other fixed facilities, a means of conveying the same or equivalent information to persons with hearing loss or who are deaf shall be provided.

(15) Where clocks are provided for use by the general public, the clock face shall be uncluttered so that its elements are clearly visible. Hands, numerals, and/or digits shall contrast with the background either light on dark or dark on light. Where clocks are mounted overhead, numerals and/or digits shall comply with Section 11-4.30.3. Clocks shall be placed in uniform locations throughout the facility and system to the maximum extent practicable.

(16) Where provided in below grade stations, escalators shall have a minimum clear width of 32 inches (813 mm). At the top and bottom of each escalator run, at least two contiguous treads shall be level beyond the comb plate before the risers begin to form. All escalator treads shall be marked by a strip of clearly contrasting color, 2 inches (51 mm) in width, placed parallel to and on the nose of each step. The strip shall be of a material that is at least as slip resistant as the remainder of the tread. The edge of the tread shall be apparent from both ascending and descending directions.

(17) Where provided, elevators shall be glazed or have transparent panels to allow an unobstructed view both into and out of the car. Elevators shall comply with Section 11-4.10.

Exception: Elevator cars with a clear floor area in which a 60-inch (1524 mm) diameter circle can be inscribed may be substituted for the minimum car dimensions of Section 11-4.10 and Figure 22.

(18) Where provided, ticketing areas shall permit persons with disabilities to obtain a ticket and check baggage and shall comply with Section 11-7.2.

(19) Where provided, baggage check-in and retrieval systems shall be on an accessible route complying with Section 11-4.3, and shall have space immediately adjacent complying with Section 11-4.2. If unattended security barriers are provided, at least one gate shall comply with Section 11-4.13. Gates which must be pushed open by wheelchair or mobility aid users shall have a smooth continuous surface extending from 2 inches (51 mm) above the floor to 27 inches (686 mm) above the floor.

11-10.3.2 Existing facilities: Key stations.

(1) Rapid, light and commuter rail key stations, as defined under criteria established by the Department of Transportation in Subpart C or 49 CFR Part 37 and existing intercity rail stations shall provide at least one accessible route from an accessible entrance to those areas necessary for use of the transportation system.

(2) The accessible route required by Section 11-10.3.2(1) shall include the features specified in Section 11-10.3.1(1), Sections 11-10.3.1(4) through 11-10.3.1(9), Sections 11-10.3.1(11) through 11-10.3.1(15), and Sections 11-10.3.1(17) through 11-10.3.1(19).

(3) Where technical infeasibleness in existing stations requires the accessible route to lead from the public way to paid area of the transit system, an accessible fare collection system, complying with Section 11-10.3.1(7), shall be provided along such accessible route.

(4) In light rail, rapid rail and commuter rail key stations, the platform or a portion thereof and the vehicle floor shall be coordinated so that the vertical difference, measured when the vehicle is at rest, within plus or minus $1^1/_2$ inches (38 mm) under all normal passenger load conditions, and the horizontal gap, measured when the vehicle is at rest, is not greater than 3 inches (76 mm) for at lease one door of each vehicle or car required to be accessible by 49 CFR Part 37.

Exceptions:

1. Existing vehicles retrofitted to meet the requirements of 49 CFR 37.93 (one-car-per-trail rule) shall be coordinated with the platform such that, for at lease one door, the vertical difference between the vehicle floor and the platform, measured when the vehicle is at rest with 50-percent normal passenger capacity, is within plus or minus 2 inches (51 mm) and the horizontal gap is no greater than 4 inches (102 mm).
2. Where it is not structurally or operationally feasible to meet the horizontal gap or vertical difference requirements, minihigh platforms, car-borne or platform mounted lifts, ramps or bridge plates, or similar manually deployed devices, meeting the applicable requirements of 36 CFR Part 1192, 49 CFR Part 38, shall suffice.

(5) New direct connections to commercial, retail, or residential facilities shall, to the maximum extent feasible, have an accessible route complying with Section 11-4.3 from the point of connection to boarding platforms and all transportation system elements used by the public. Any elements provided to facilitate future direct connections shall be on an accessible route connecting boarding platforms and all transportation system elements used by the public.

11-10.3.3 Existing facilities: Alterations.

(1) For the purpose of complying with Section 11-4.1.6(2) an area of primary function shall be as defined by applicable provisions of 49 CFR 37.43(c) (Department of Transportation's ADA Rule) or 28 CFR 36.403 (Department of Justice's ADA Rule).

11-10.4 Airports.

11-10.4.1 *New construction.*

(1) Elements such as ramps, elevators or other vertical circulation devices, ticketing areas, security checkpoints, or passenger waiting areas shall be placed to minimize the distance which wheelchair users and other persons who cannot negotiate steps may have to travel compared to the general public.

(2) The circulation path, including an accessible entrance and an accessible route, for persons with disabilities shall, to the maximum extent practicable, coincide with the circulation path for the general public. Where the circulation path is different, directional signage complying with Sections 11-4.30.1, 11-4.30.2, 11-4.30.3 and 11-4.30.5 shall be provided which indicates the location of the nearest accessible entrance and it accessible route.

(3) Ticketing areas shall permit persons with disabilities to obtain a ticket and check baggage and shall comply with Section 11-7.2.

(4) Where public pay telephones are provided, and at least one is at an interior location, a public text telephone shall be provided in compliance with Section 11-4.31.9. Additionally, if four or more public pay telephones are located any of the following locations, at least one public text telephone shall also be provided in that location:

(a) A main terminal outside the security areas;

(b) A concourse within the security areas; or

(c) A baggage claim area in a terminal. Compliance with this section constitutes compliance with Section 11-4.1.3(17)(c).

(5) Baggage check-in and retrieval systems shall be on an accessible route complying with Section 11-4.3, and shall have space immediately adjacent complying with with Section 11-4.2.4. If unattended security barriers are provided, at least one gate shall comply with Section 11-4.13. Gates which must be pushed open by wheelchair or mobility aid users shall have a smooth continuous surface extending from 2 inches (51 mm) above the floor to 27 inches (686 mm) above the floor.

(6) Terminal information systems which broadcast information to the general public through a public address system shall provide a means to provide the same or equivalent information to persons with a hearing loss or who are deaf. Such methods may include, but are not limited to, visual paging systems using video monitors and computer technology. For persons with certain types of hearing loss such methods may include, but are not limited to, an assistive listening system complying with Section 11-4.33.7.

(7) Where clocks are provided for use by the general public the clock face shall be uncluttered so that its elements are clearly visible. Hands, numerals, and/or digits shall contrast with their background either light on dark or dark on light. Where clocks are

mounted over head, numerals and/or digits shall comply with Section 11-4.30.3. Clocks shall be placed in uniform locations throughout the facility to the maximum extent practicable.

(8) Security systems. Reserved.

11-10.5 Boat and ferry docks. Reserved.

SECTION 11-11
RESIDENTIAL BUILDINGS

11-11.1 Accessibility residential housing, Florida. Reserved.

(1) All new single-family houses, duplexes, triplexes, condominiums, and townhouses shall provide at least one bathroom, located with maximum possible privacy, where bathrooms are provided on habitable grade levels, with a door that has a 29-inch (737 mm) clear opening. However, if only a toilet room is provided at grade level, such toilet rooms shall have a clear opening of not less than 29 inches (737 mm).

(2) Buildings, structures, or facilities being converted from residential to nonresidential or mixed use shall comply with the requirements of Section 11-4.1.6.

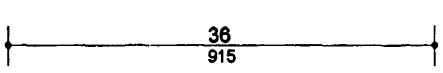
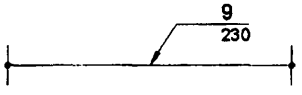
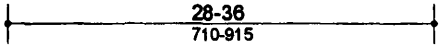
SECTION 11-12
THEME PARK OR AN ENTERTAINMENT COMPLEX

(1) A theme park or an entertainment complex [as defined in Section 509.013(9) *Florida Statutes*, see definitions] in which are provided continuous attendant services for directing individuals to marked accessible parking spaces or designated lots for parking by persons who have disabilities, the park or complex may, in lieu of the required parking space design (see Section 11-4.6), provide parking spaces that comply with the alternative design of Figure 9(b). When the alternative parking space designs are used, van accessible spaces shall be provided in compliance with Section 11-4.1.2(5)(b) of this code. Accessible parking spaces shall be at least 96 inches (2440 mm) wide. Parking access aisles shall be part of an accessible route to the building or facility entrance and shall comply with Section 11-4.3. Two accessible parking spaces may share a common access aisle [see Figure 9(a) and Figure 9(b)]. Parking vehicle overhangs shall not reduce the clear width of an accessible route. Parking spaces and access aisles shall be level with surface slopes not exceeding 1:50 (2 percent) in all directions.

(2) If a theme park or an entertainment complex [as defined in Section 509.013(9), *Florida Statutes*], provides parking in several lots or areas from which access to the theme park or entertainment complex is provided, a single lot or area may be designated for parking by persons who have disabilities, if the lot or area is located on the shortest safely accessible route to an accessible entrance to the theme park or entertainment complex or to transportation to such an accessible entrance.

TABLE 1
GRAPHIC CONVENTIONS

Table 1
Graphic Conventions

Convention		Description
		Typical dimension line showing U.S. customary units (in inches) above the line and SI units (in millimeters) below.
		Dimensions for short distances indicated on arrow.
		Dimensions line for showing range of dimension
		Direction of approach
max		Maximum
min		Minimum
		Boundary of clear floor area
	CL	Centerline

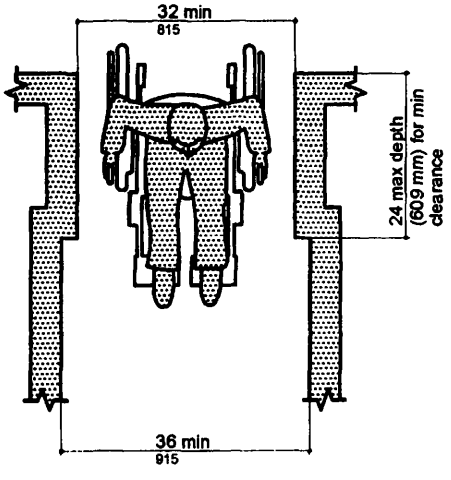


FIGURE 1
MINIMUM CLEAR WIDTH
FOR SINGLE WHEELCHAIR

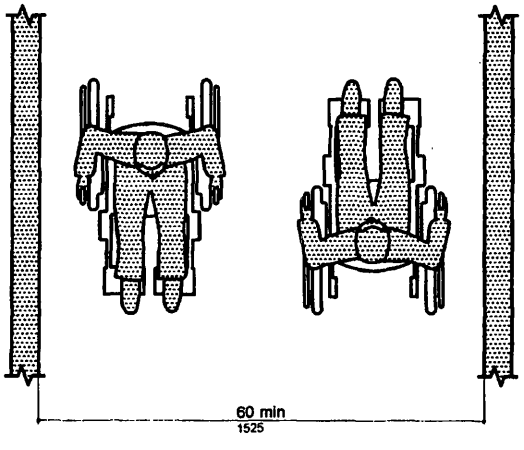
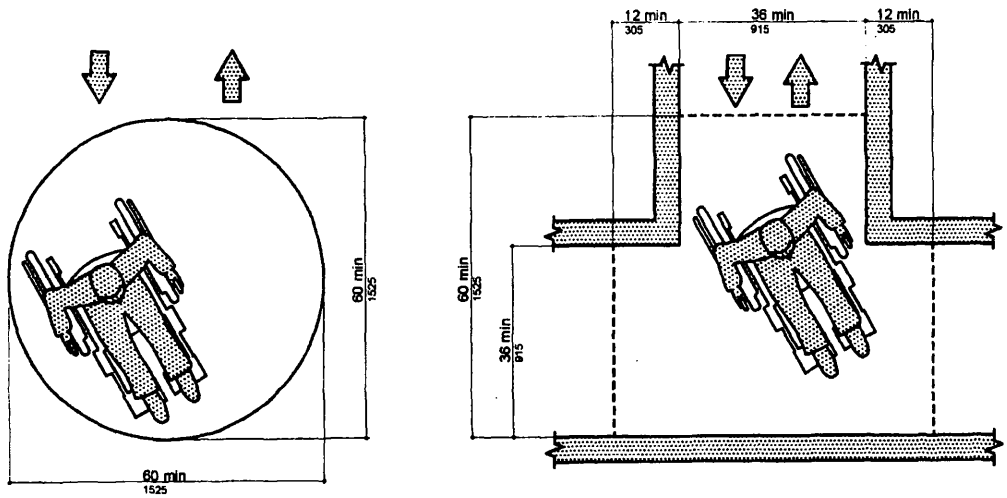


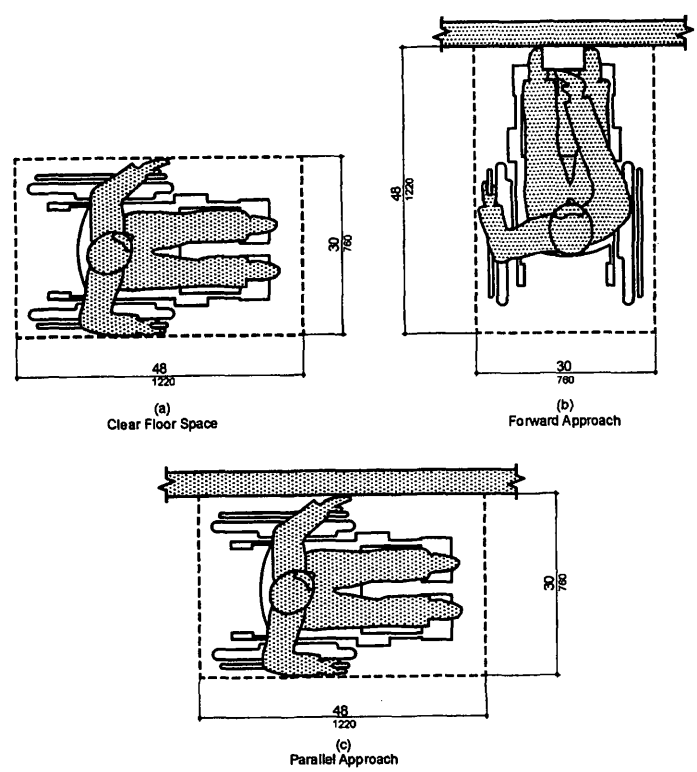
FIGURE 2
MINIMUM CLEAR WIDTH
FOR TWO WHEELCHAIRS



(a)
60-in (1525-mm)
Diameter Space

(b)
T-Shaped Space
for 180° Turn

FIGURE 3
WHEELCHAIR TURNING SPACE

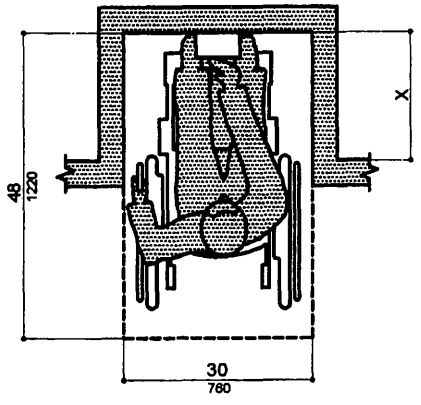


(a)
Clear Floor Space

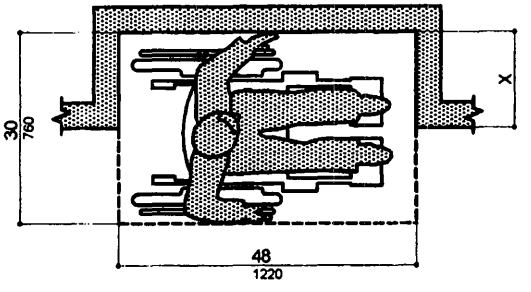
(b)
Forward Approach

(c)
Parallel Approach

FIGURE 4
MINIMUM CLEAR FLOOR SPACE FOR WHEELCHAIRS

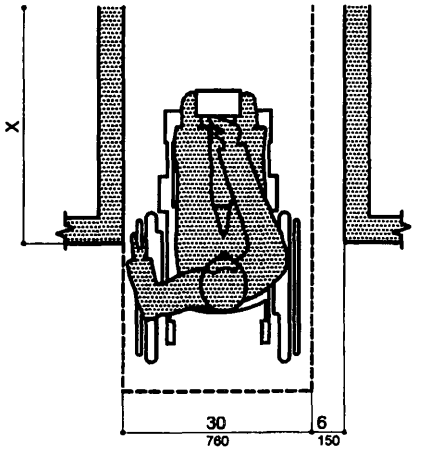


NOTE: X ≤ 24 in. (610 mm)

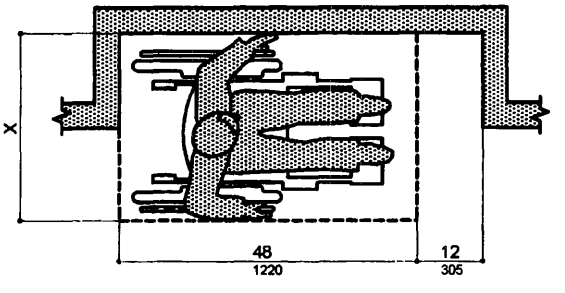


NOTE: X ≤ 15 in. (380 mm)

(d)
CLEAR FLOOR SPACE IN ALCOVES



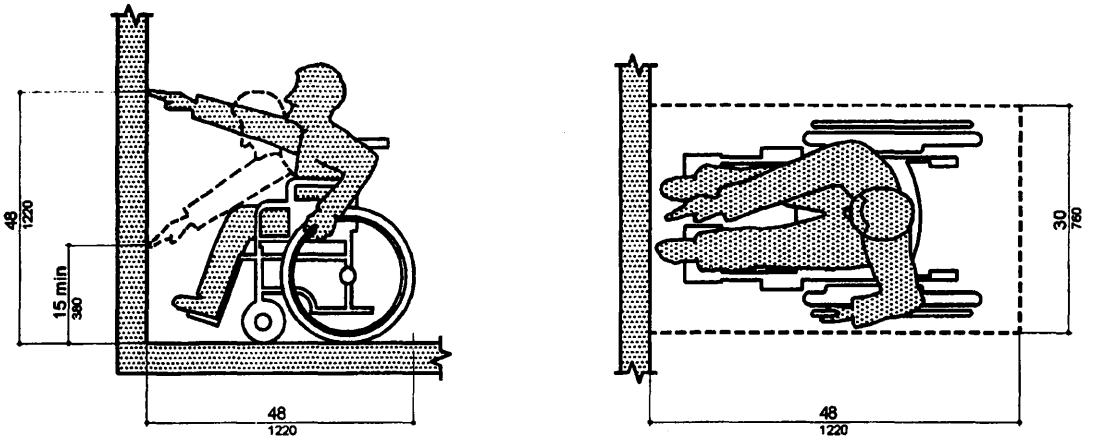
NOTE: IF X > 24 in. (610 mm), THEN AN ADDITIONAL MANEUVERING CLEARANCE OF 6 in. (150 mm) SHALL BE PROVIDED AS SHOWN.



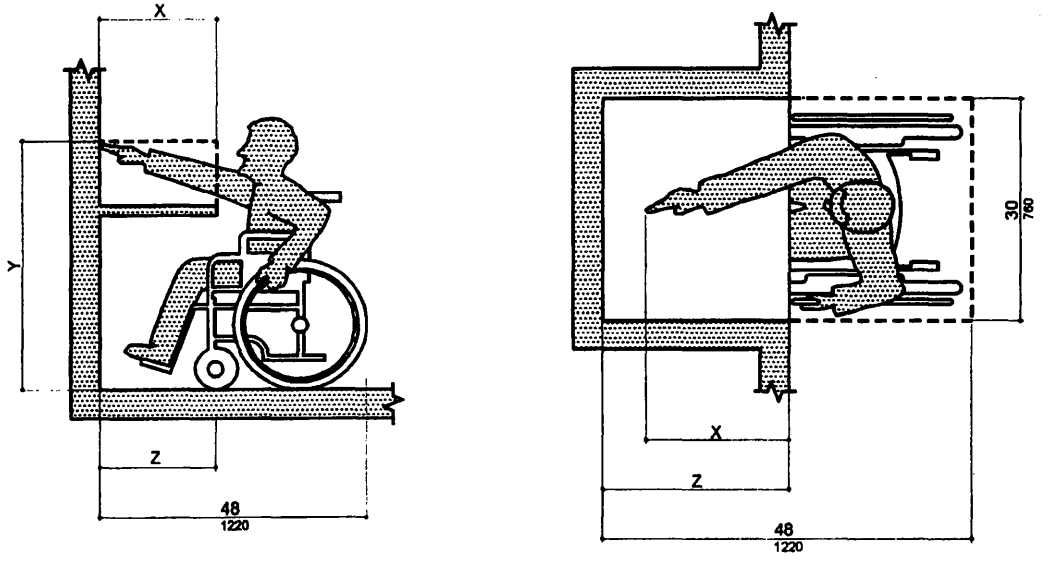
NOTE: IF X > 15 in. (380 mm), THEN AN ADDITIONAL MANEUVERING CLEARANCE OF 12 in. (305 mm) SHALL BE PROVIDED AS SHOWN.

(e)
ADDITIONAL MANEUVERING CLEARANCES FOR ALCOVES

FIGURE 4 (continued)
MINIMUM CLEAR FLOOR SPACE FOR WHEELCHAIRS



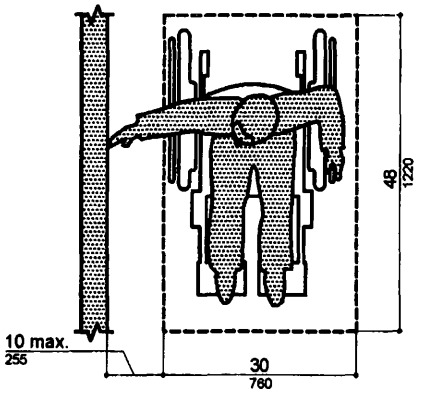
(a)
High Forward Reach Limit



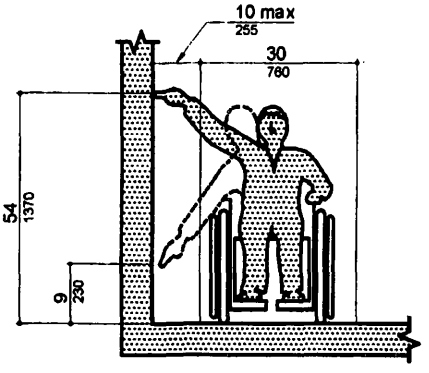
NOTE: X SHALL BE ≤ 25 in. (635 mm); Z SHALL BE ≥ X.
WHEN X < 20 in. (510 mm). THEN Y SHALL BE 48 in.
(1220 mm) MAXIMUM. WHEN X IS 20 TO 25 in. (510 mm TO
635 mm), THEN Y SHALL BE 44 in. (1120 mm) MAXIMUM.

(b)
Maximum Froward Reach Over an Obstruction

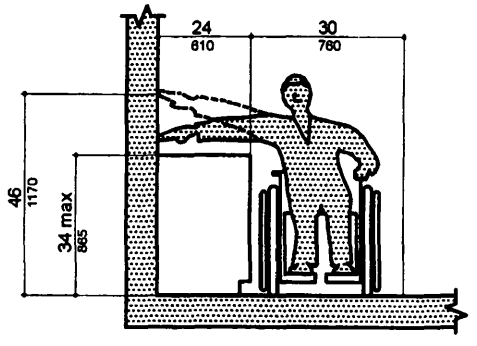
FIGURE 5
FORWARD REACH



(a)
Clear Floor Space
Parallel Approach

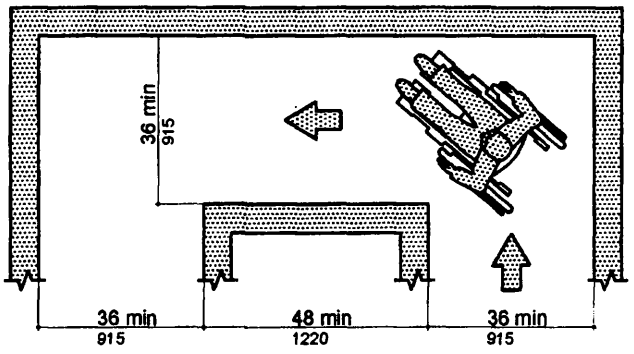


(b)
High and Low
Side Reach Limits

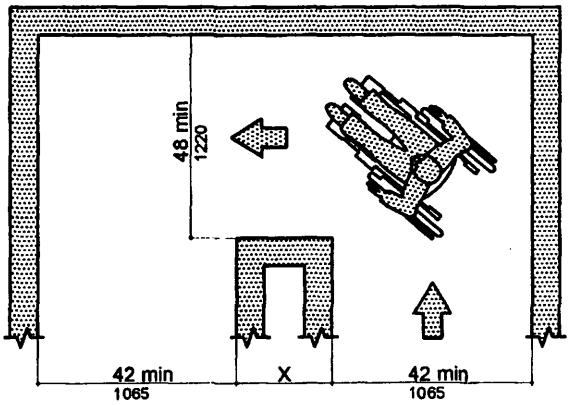


(c)
Maximum Side Reach Over Obstruction

FIGURE 6
SIDE REACH

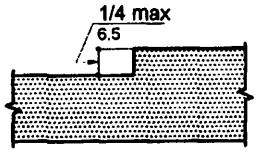


(a)
90° Turn

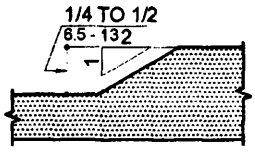


NOTE: Dimensions shown apply when X < 48 in. (1220 mm)

(b)
Turns Around an Obstruction

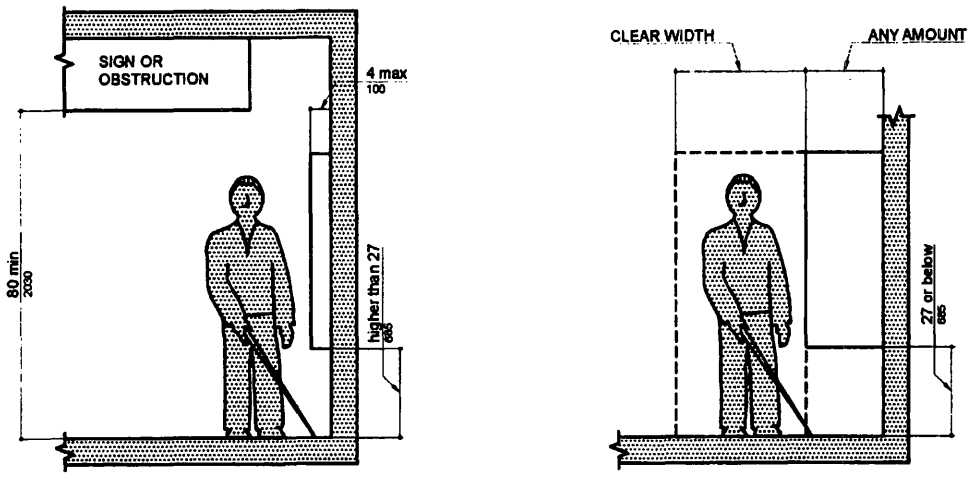


(c)
Changes in Level

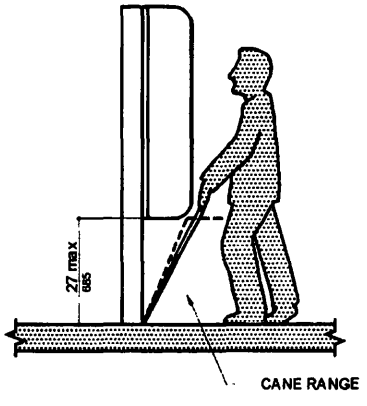


(d)
Changes in Level

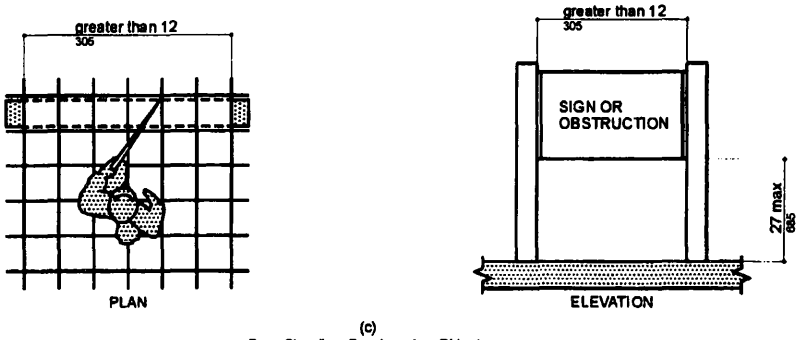
FIGURE 7
ACCESSIBLE ROUTE



(a)
Walking Parallel to a Wall

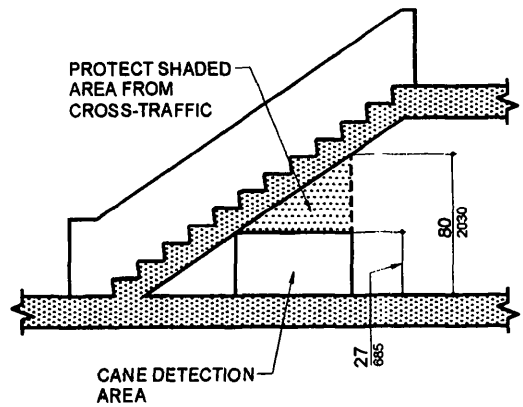


(b)
Walking Perpendicular to a Wall

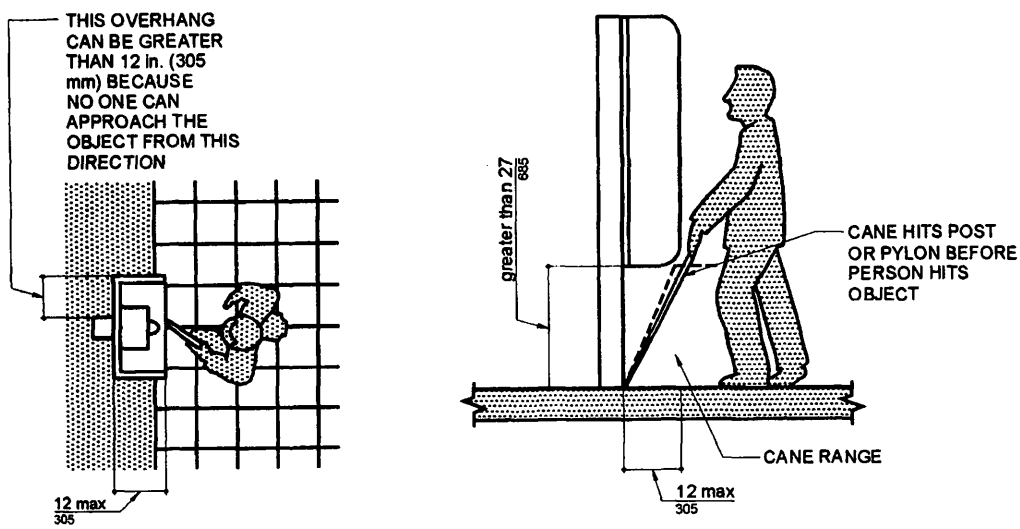


(c)
Free-Standing Overhanging Objects

FIGURE 8
PROTRUDING OBJECTS

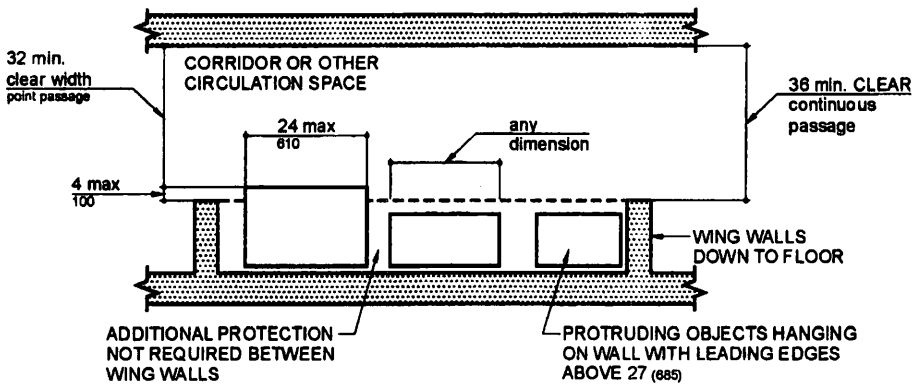


(c-1)
Overhead Hazards

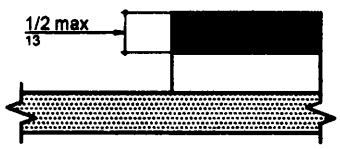


(d)
Objects Mounted on Posts or Pylons

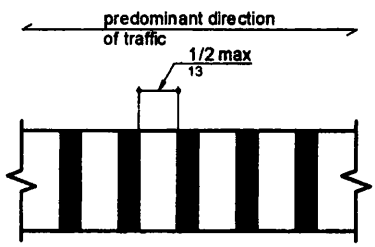
FIGURE 8
PROTRUDING OBJECTS (continued)



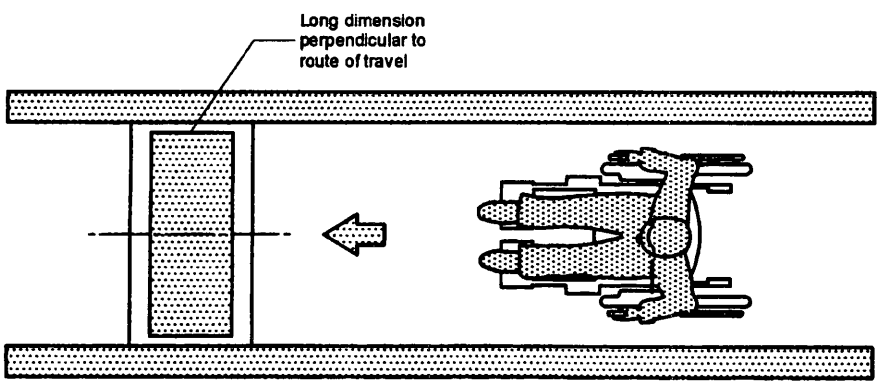
(e)
Example of Protection Around Wall-Mounted Objects
and Measurements of Clear Widths



(f)
Carpet Pile Thickness



(g)
Gratings



(h)
Grating Orientation

FIGURE 8
PROTRUDING OBJECTS (continued)

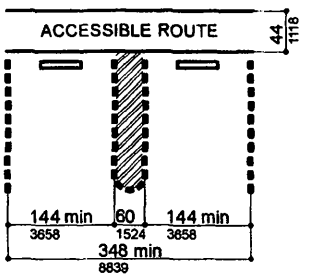


FIGURE 9(A)
STANDARDS PARKING SPACE DESIGN

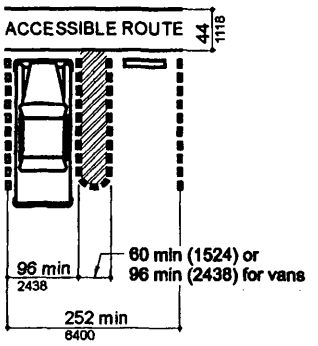


FIGURE 9(B)
ALTERNATIVE PARKING SPACES FOR
THEME PARK AND ENTERTAINMENT COMPLEX ONLY

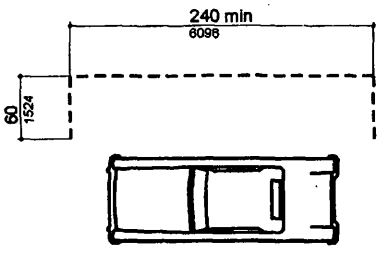


FIGURE 10
ACCESS AISLE AT PASSENGER LOADING ZONES

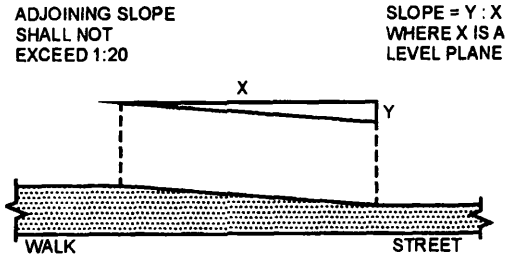


FIGURE 11
MEASUREMENT OF CURB RAMP SLOPES

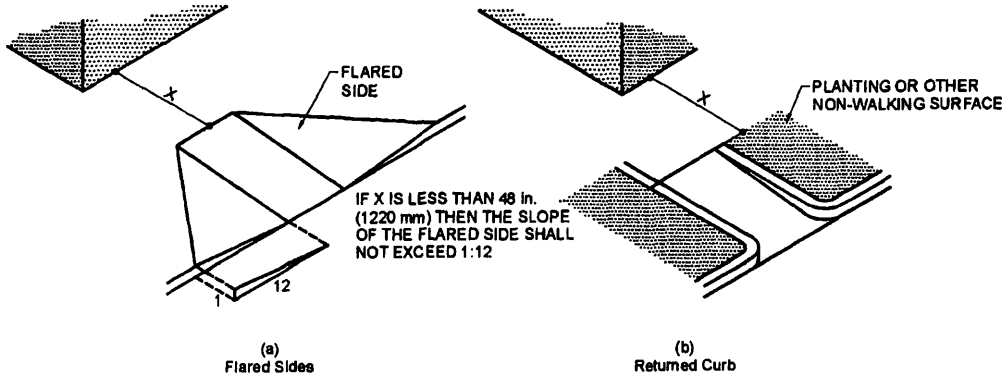


FIGURE 12
SIDES OF CURB RAMPS

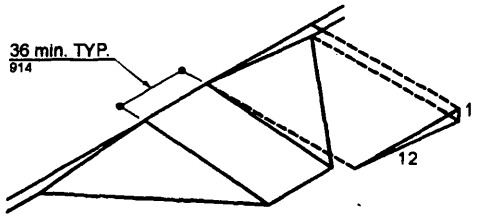


FIGURE 13
BUILT-UP CURB RAMP

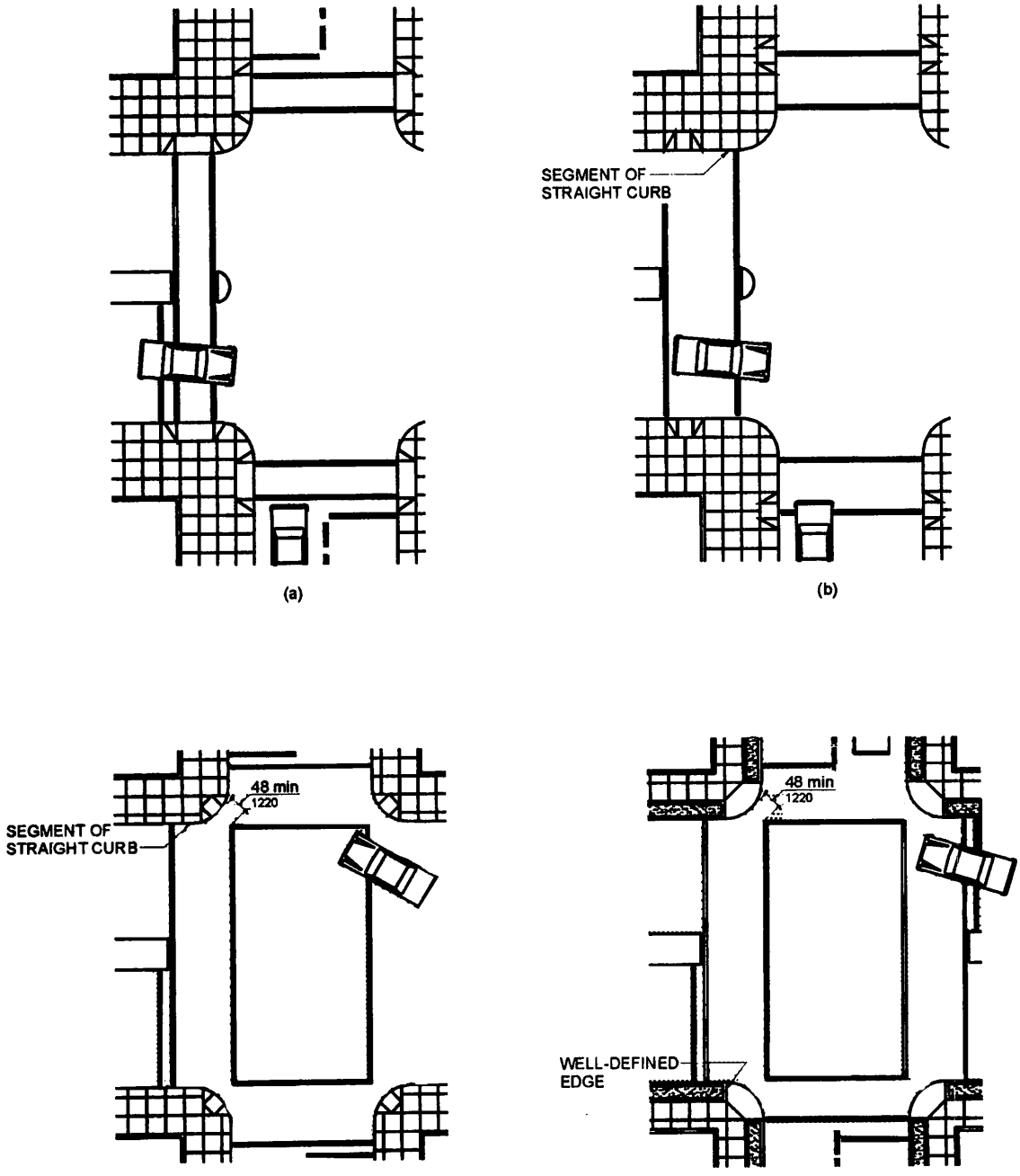
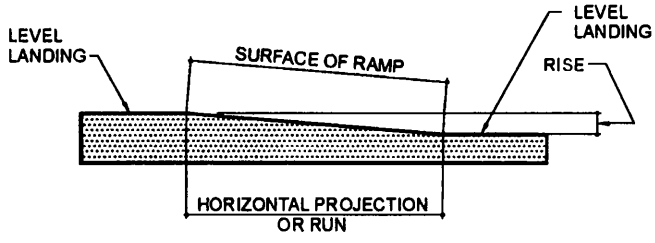


FIGURE 15
CURB RAMPS AT MARKED CROSSINGS



	Maximum Rise		Maximum Horizontal Projection	
Slope	in.	mm	ft	m
1:12 to < 1:16	30	760	30	9
1:16 to < 1:20	30	760	40	12

FIGURE 16
COMPONENTS OF A SINGLE RAMP RUN AND SAMPLE RAMP DIMENSIONS

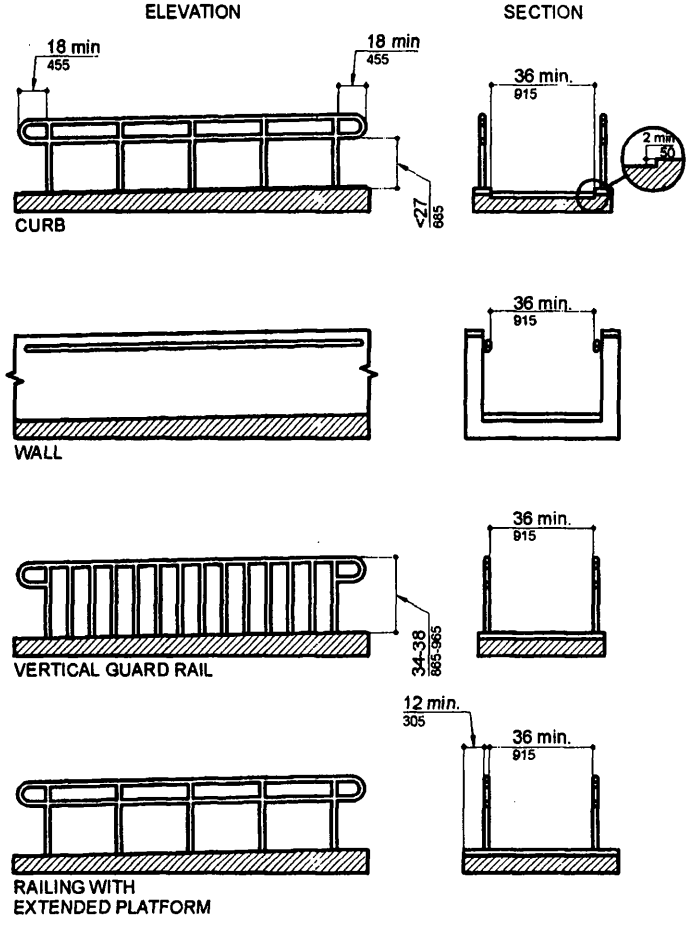


FIGURE 17
EXAMPLES OF EDGE PROTECTION AND HANDRAIL EXTENSIONS

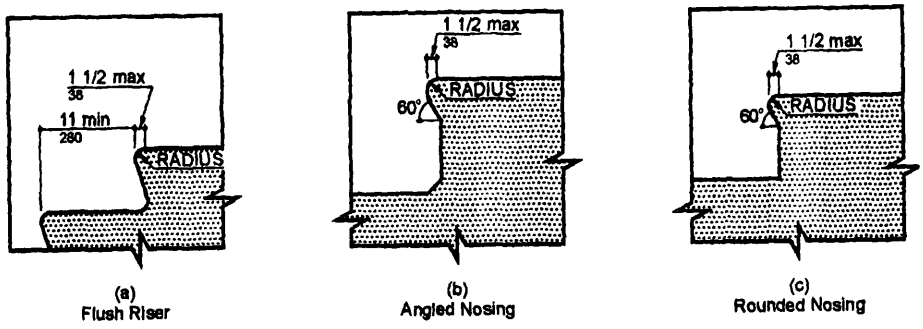
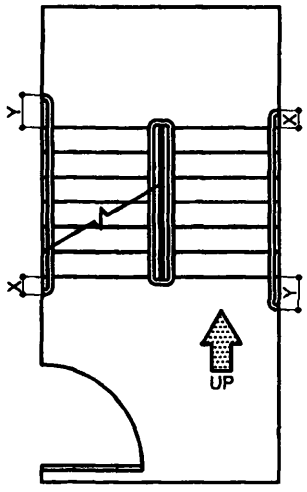
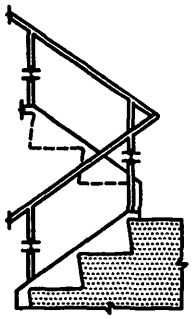


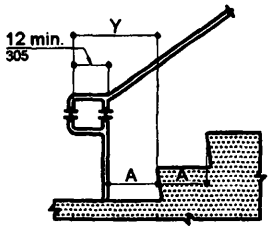
FIGURE 18
USABLE TREAD WIDTH AND EXAMPLES OF ACCEPTABLE NOSINGS



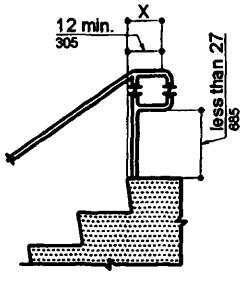
(a)
Plan



(b)
Elevation of
Center Handrail



(c)
Extension at
Bottom of Run

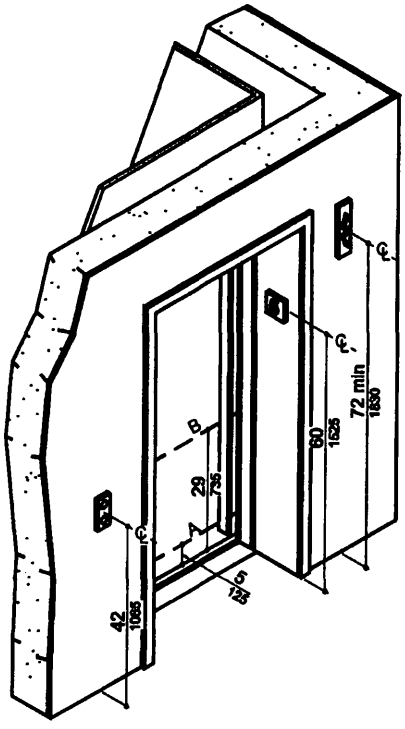


(d)
Extension at
Top of Run

NOTE: X IS THE 12 IN. MINIMUM HANDRAIL EXTENSION REQUIRED AT EACH TOP RISER

Y IS THE MINIMUM HANDRAIL EXTENSION OF 12 IN. PLUS THE WIDTH OF ONE TREAD THAT IS REQUIRED AT EACH BOTTOM RISER.

FIGURE 19
STAIR HANDRAILS



NOTE: The automatic door reopening device is activated if an object passes through either line A or B. Line A and line B represent the vertical locations of the door reopening device not requiring contact.

FIGURE 20
HOISTWAY AND ELEVATOR ENTRANCES

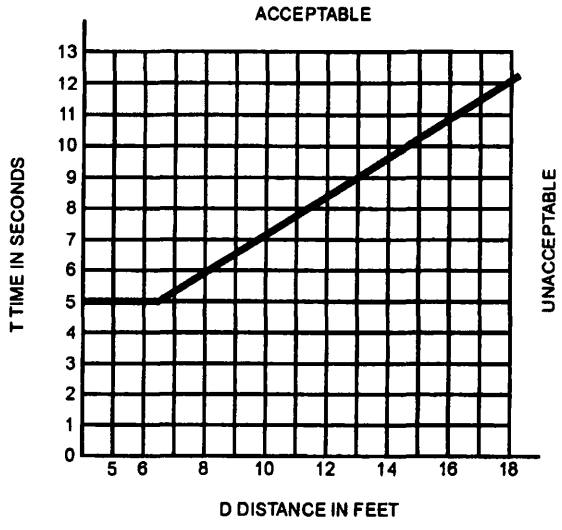


FIGURE 21
GRAPH OF TIMING EQUATION

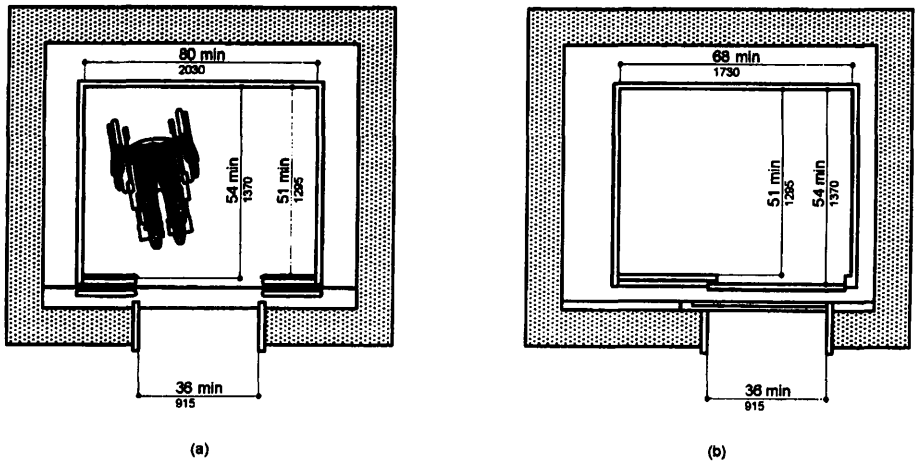
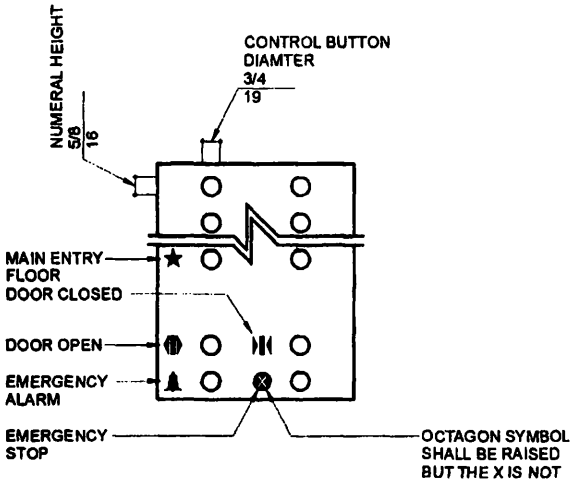
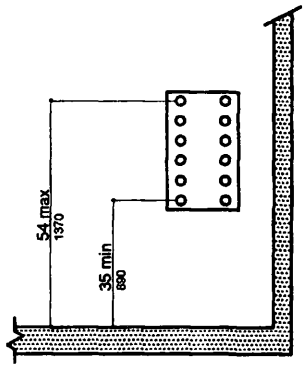


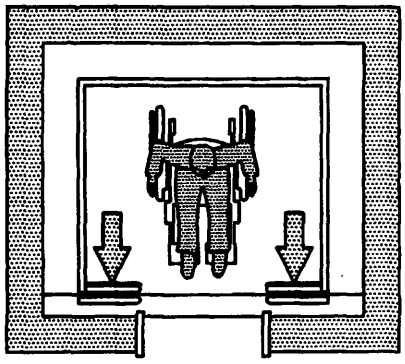
FIGURE 22
MINIMUM DIMENSIONS OF ELEVATOR CARS



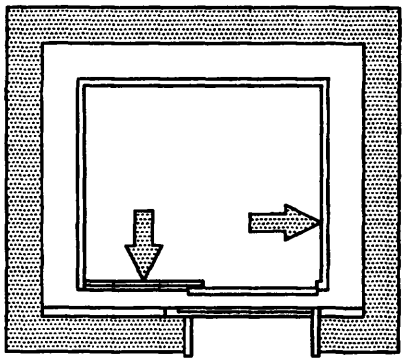
(a)
Panel Detail



(c)
Car Control Height



(b)
Alternate Locations
of Panel with
Center Opening Door



(d)
Alternate Locations
of Panel with Side Opening Door

FIGURE 23
CAR CONTROLS

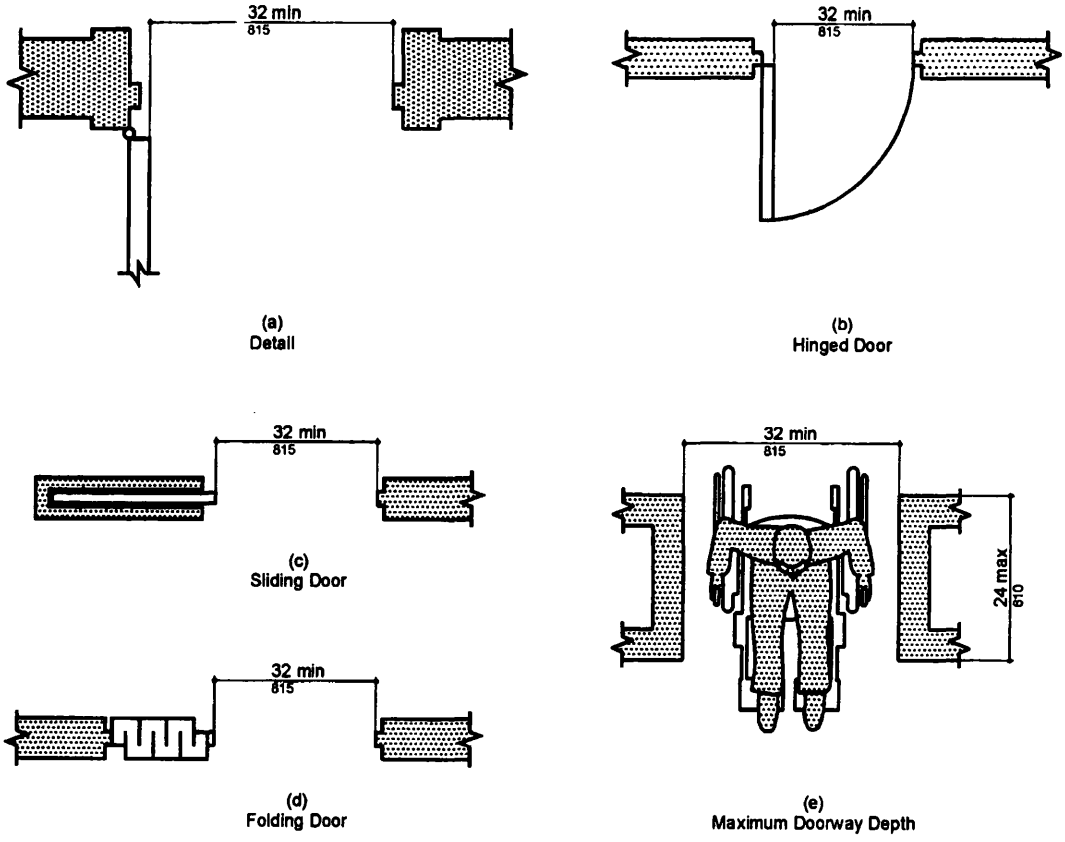
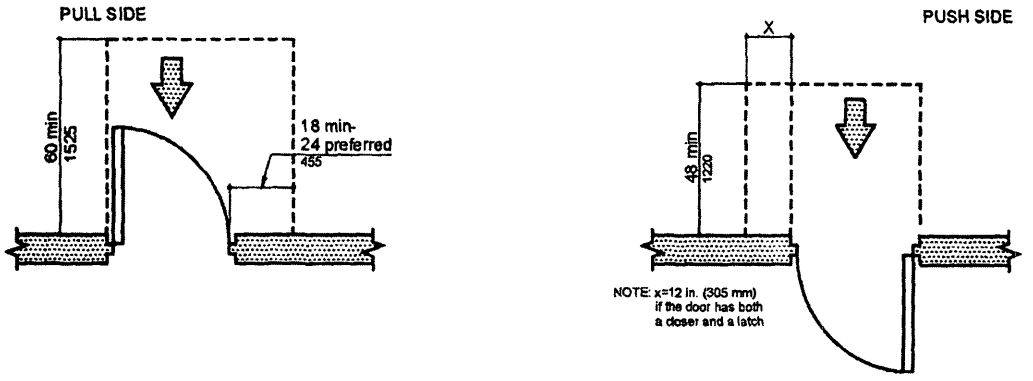
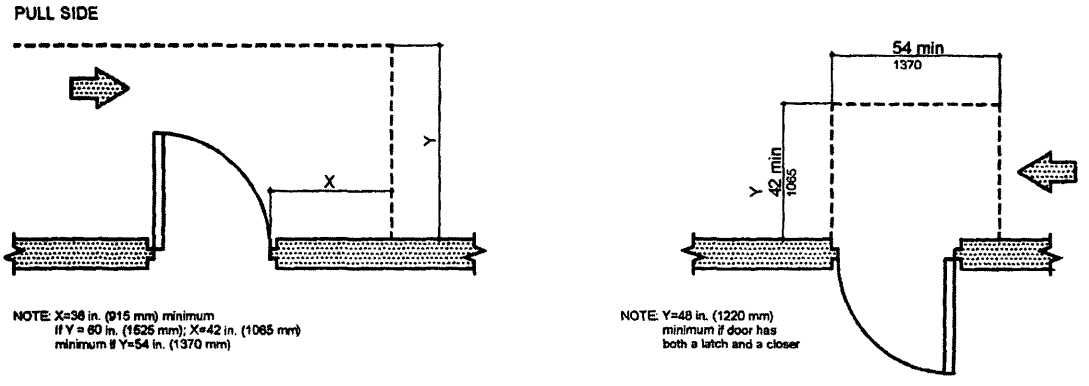


FIGURE 24
CLEAR DOORWAY WIDTH AND DEPTH



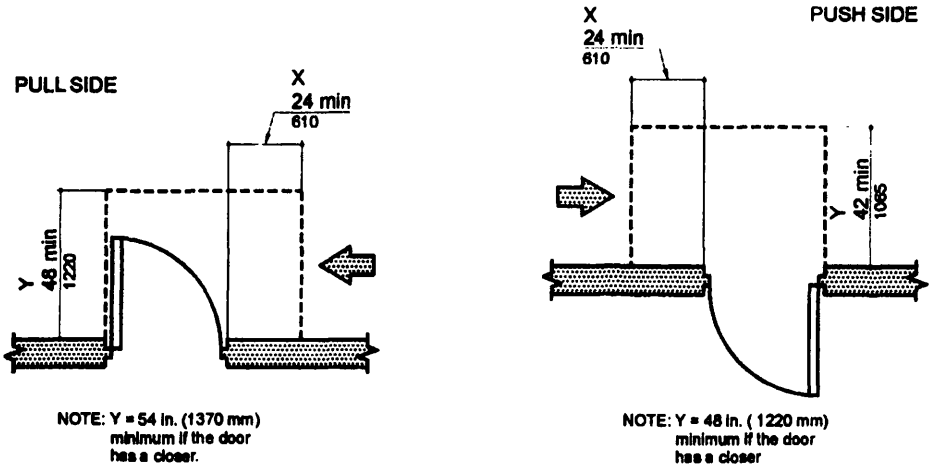
(a)
Front Approaches - Swinging Doors



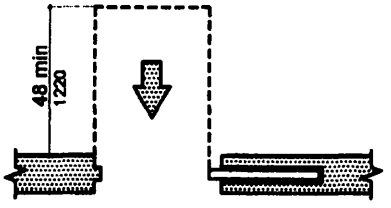
(b)
Hinge-side Approaches - Swinging Doors

NOTE: All doors in alcoves shall comply with the clearances for front approaches.

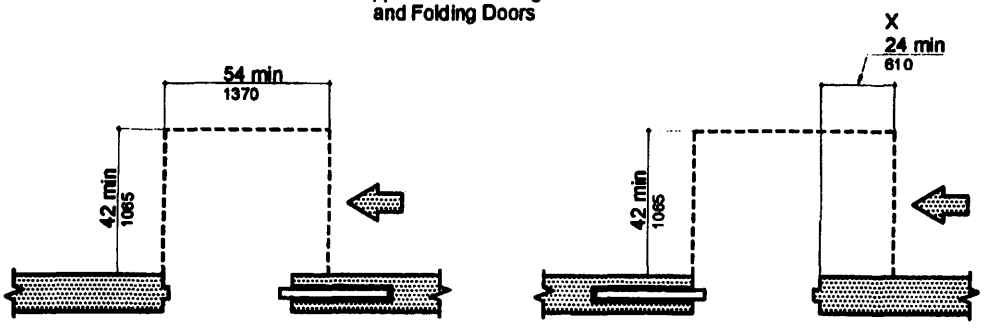
FIGURE 25
MANEUVERING CLEARANCE AT DOORS



(c)
Latch-side Approaches - Swinging Doors



(d)
Front Approaches - Sliding Doors and Folding Doors



(e)
Slide-side Approach - Sliding Doors and Folding Doors

(f)
Latch-side Approach - Sliding Doors and Folding Doors

NOTE: All doors in alcoves shall comply with the clearances for front approaches.

FIGURE 25 (continued)
MANEUVERING CLEARANCE AT DOORS

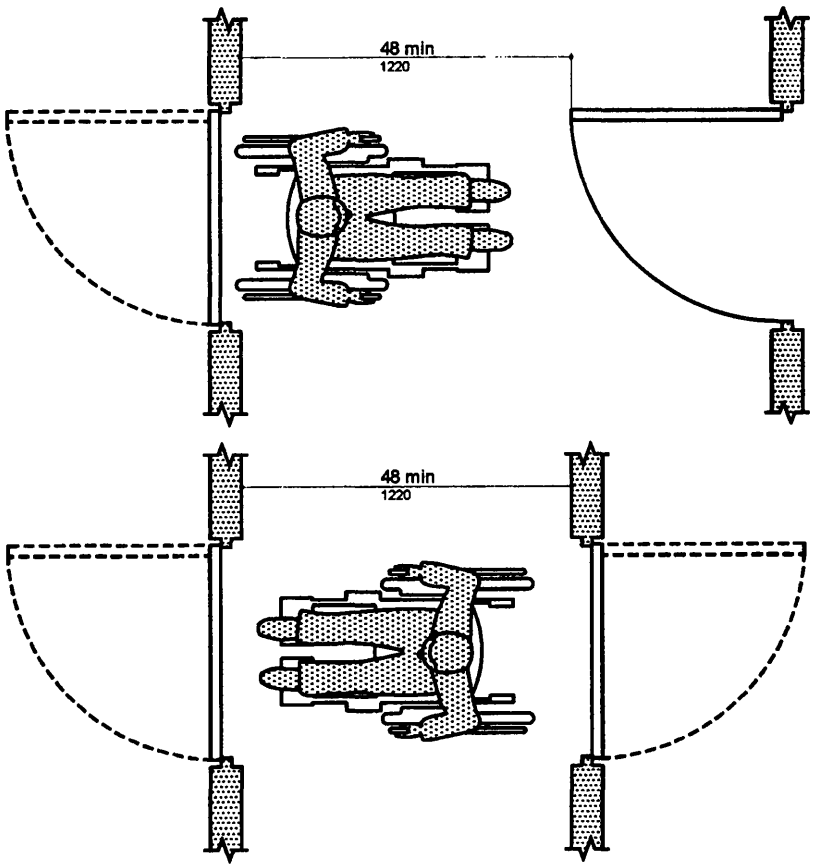


FIGURE 26
TWO HINGED DOORS IN SERIES

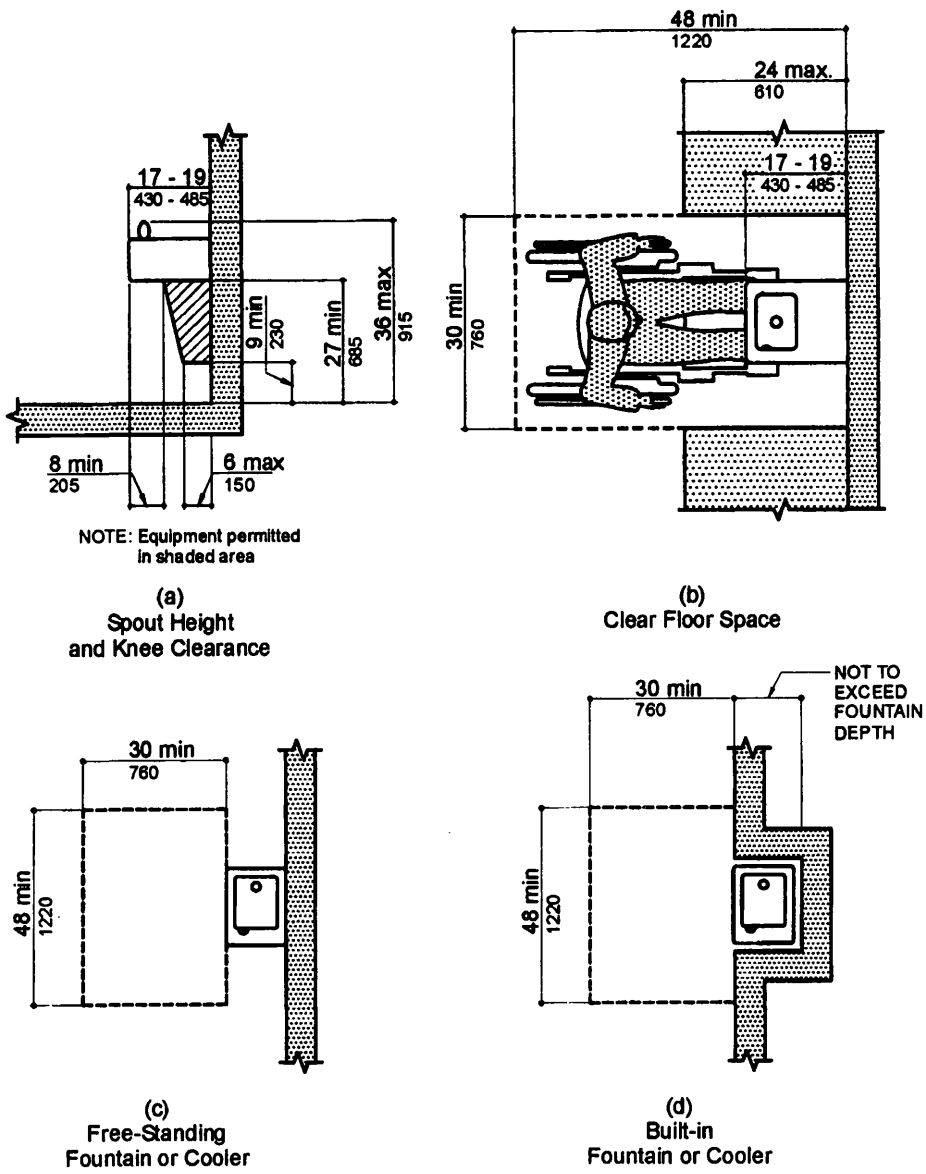


FIGURE 27
DRINKING FOUNTAINS AND WATER COOLERS

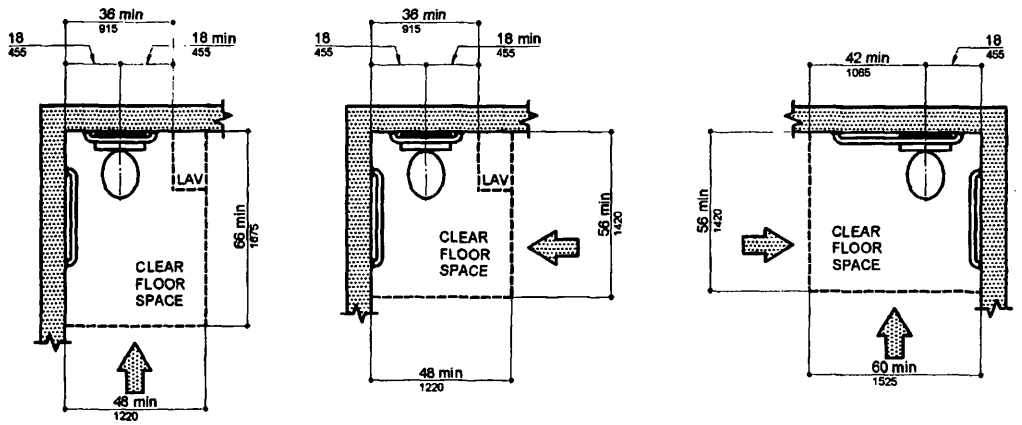
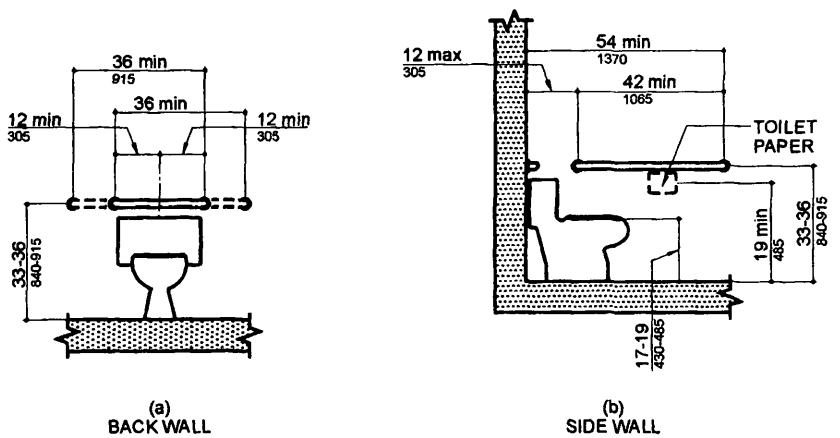


FIGURE 28
CLEAR FLOOR SPACE AT WATER CLOSETS (NOT IN STALL)



(a)
BACK WALL

(b)
SIDE WALL

FIGURE 29
GRAB BARS AT WATER CLOSETS

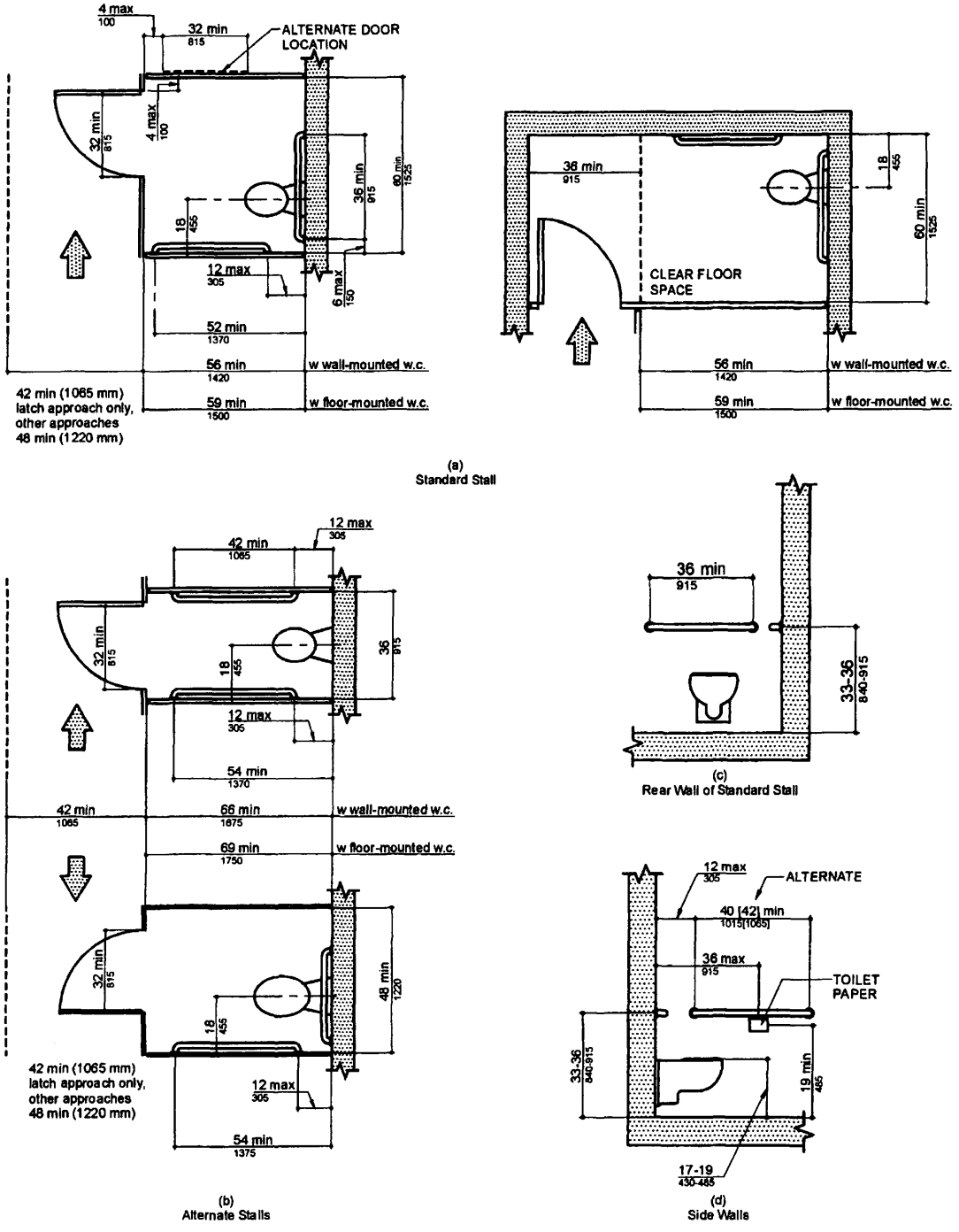
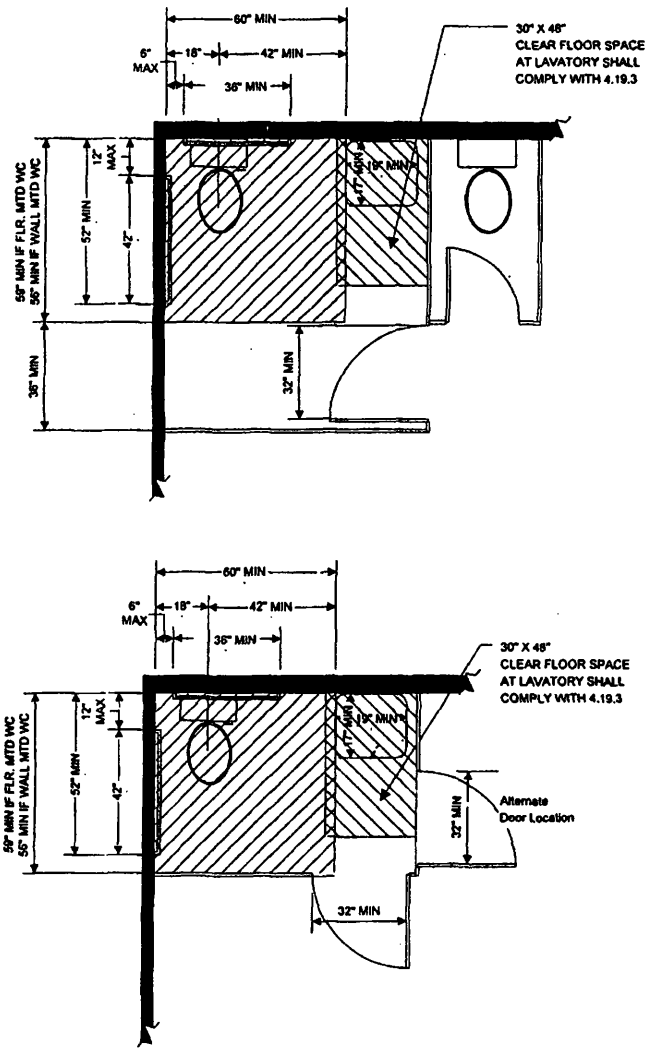


FIGURE 30
TOILET STALLS



IN NEW CONSTRUCTION, A LAVATORY SHALL BE PROVIDED WITHIN THE ACCESSIBLE TOILET STALL.
THE LAVATORY SHALL NOT ENCROACH INTO THE REQUIRED CLEAR FLOOR SPACE FOR THE WATER CLOSET.
SEE FIGURE 30 (a) FOR THE REQUIRED CLEAR FLOOR SPACE FOR THE WATER CLOSET.
THE LOCATION SHOWN FOR THE LAVATORY IS ONLY ONE OF MANY POSSIBLE LOCATIONS WITHIN THE ACCESSIBLE TOILET STALL.
THE WATER CLOSET SHALL BE LOCATED IN THE CORNER DIAGONAL TO THE DOOR.
THE TOILET STALL DOOR SHALL NOT SWING INTO THE REQUIRED CLEAR FLOOR SPACE FOR ANY FIXTURE.
FLUSH CONTROL SHALL COMPLY WITH SECTION 4.16.5.

FIGURE 30e
TOILET STALL NEW CONSTRUCTION

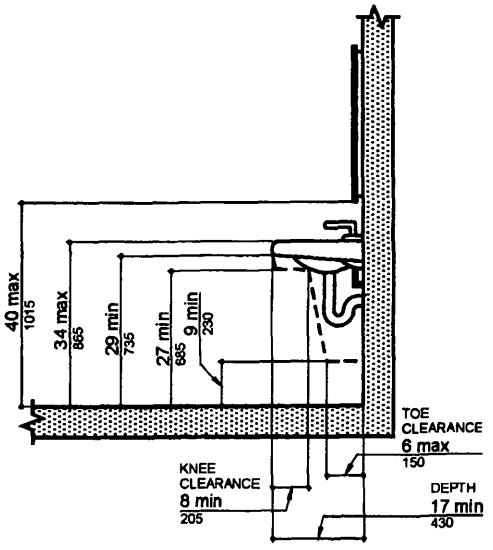


FIGURE 31
LAVATORY CLEARANCES

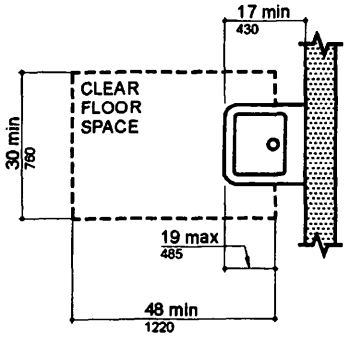
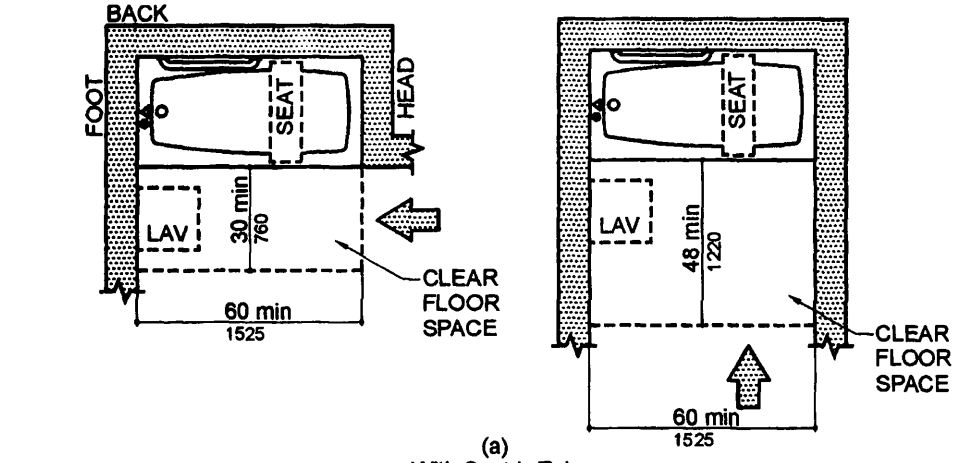
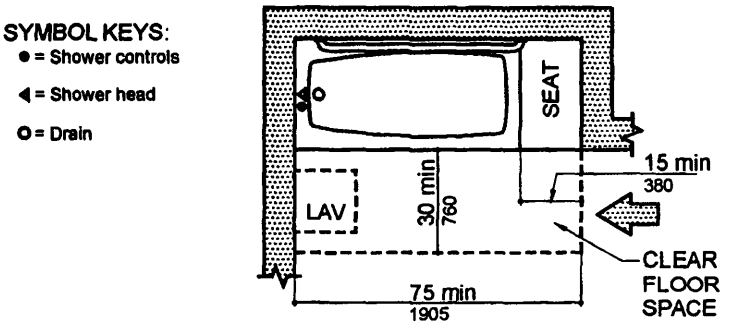


FIGURE 32
CLEAR FLOOR SPACE AT LAVATORIES

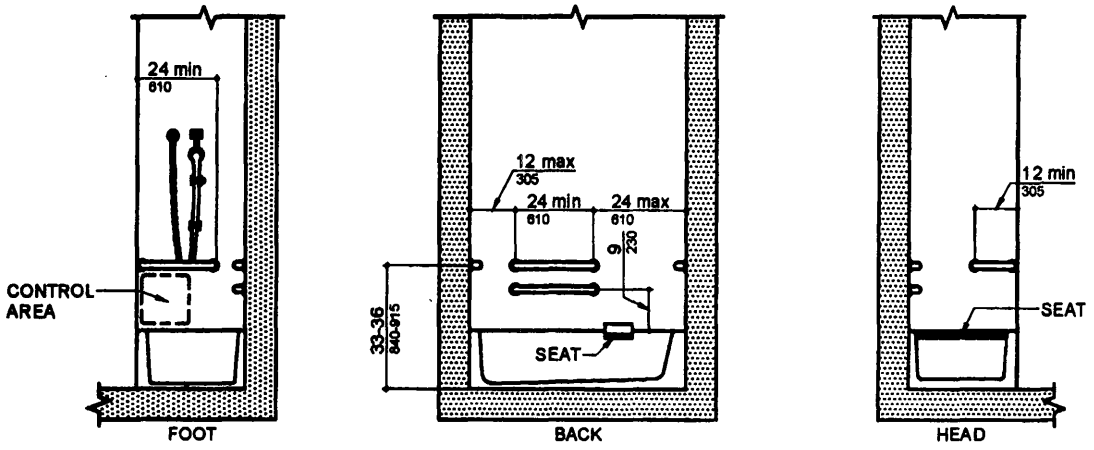


(a)
With Seat in Tub

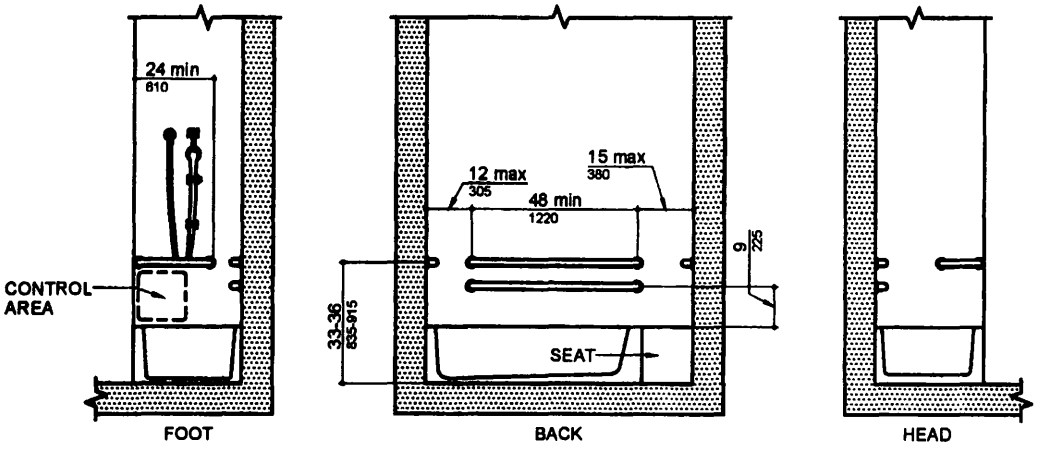


(b)
With Seat at Head of Tub

FIGURE 33
CLEAR FLOOR SPACE AT BATHTUBS



(a)
With Seat in Tub



(b)
With Seat at Head of Tub

FIGURE 34
GRAB BARS AT BATHTUBS

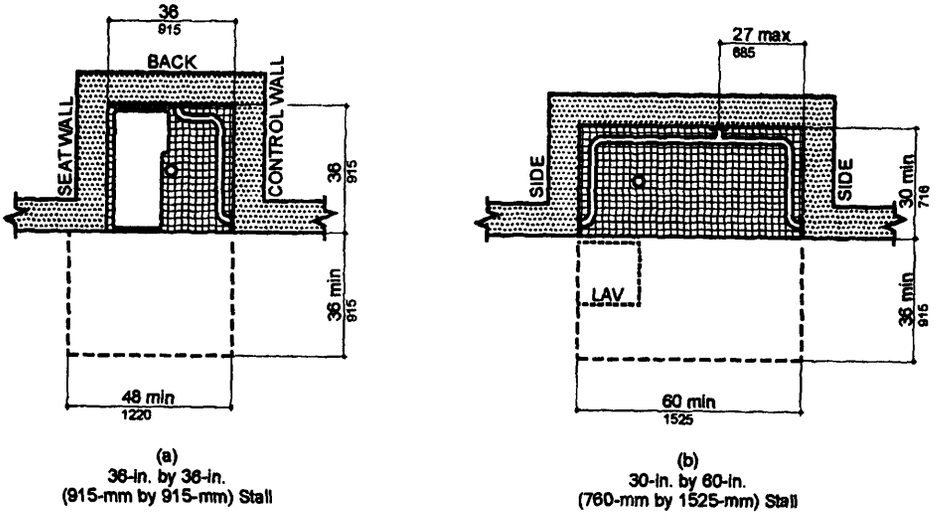


FIGURE 35
SHOWER SIZE AND CLEARANCES

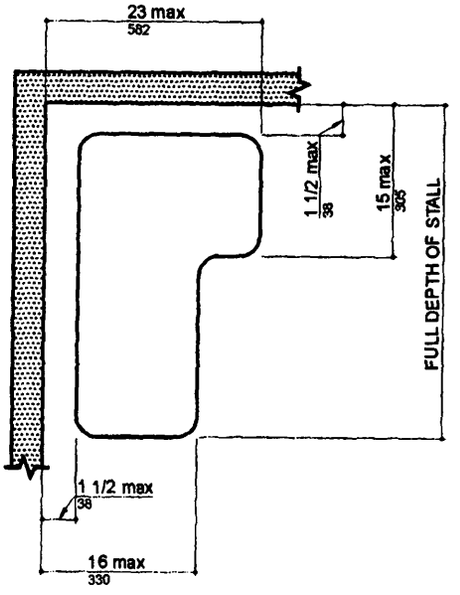
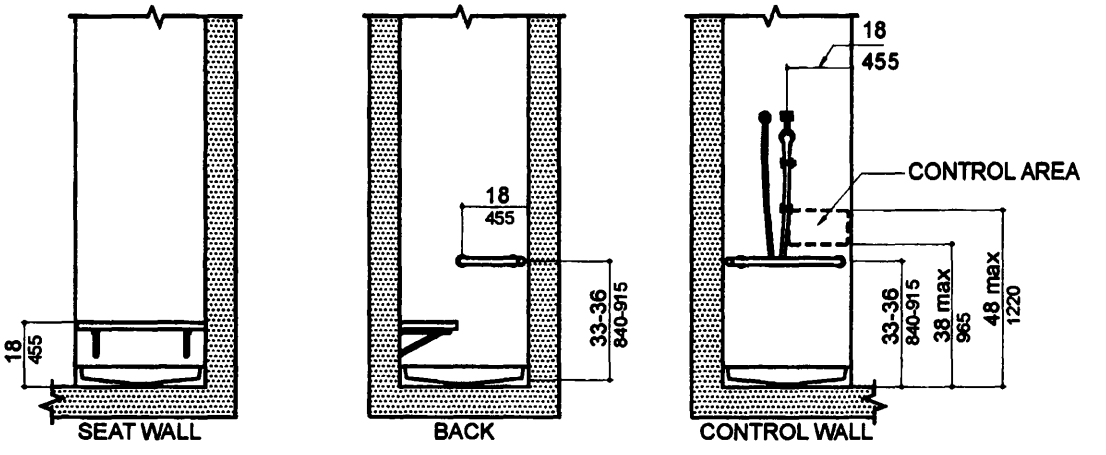
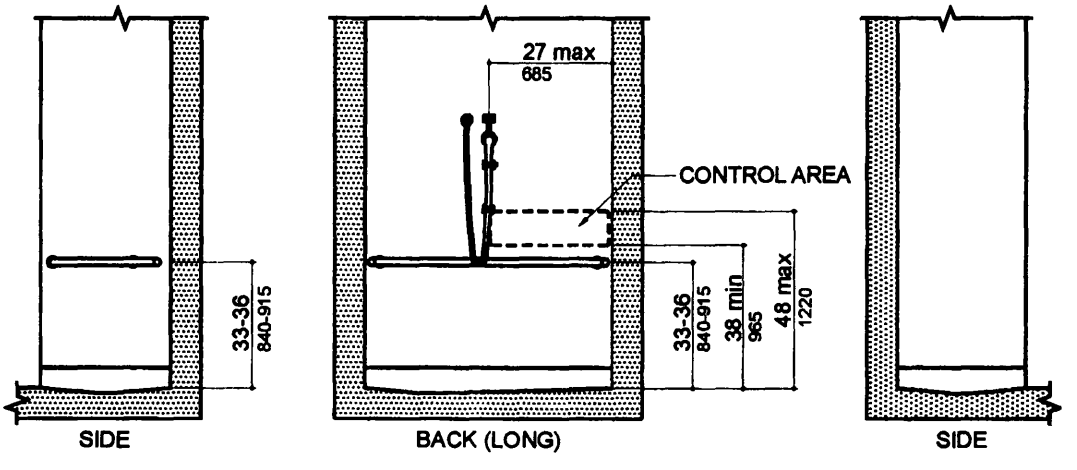


FIGURE 36
SHOWER SEAT DESIGN

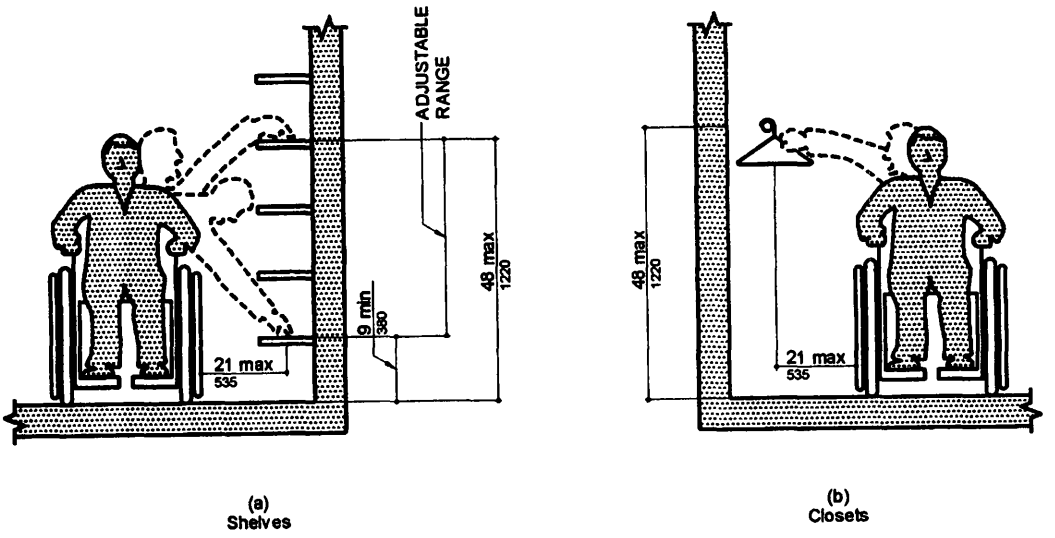


(a)
36-in by 36-in (915-mm by 915-mm) Stall



(b)
30-in by 60-in (760-mm by 1525-mm) Stall
NOTE: Shower head and control area may be on back (long) wall (as shown) or on either side wall.

FIGURE 37
GRAB BARS AT SHOWER STALLS



(a)
Shelves

(b)
Closets

FIGURE 38
STORAGE SHELVES AND CLOSETS

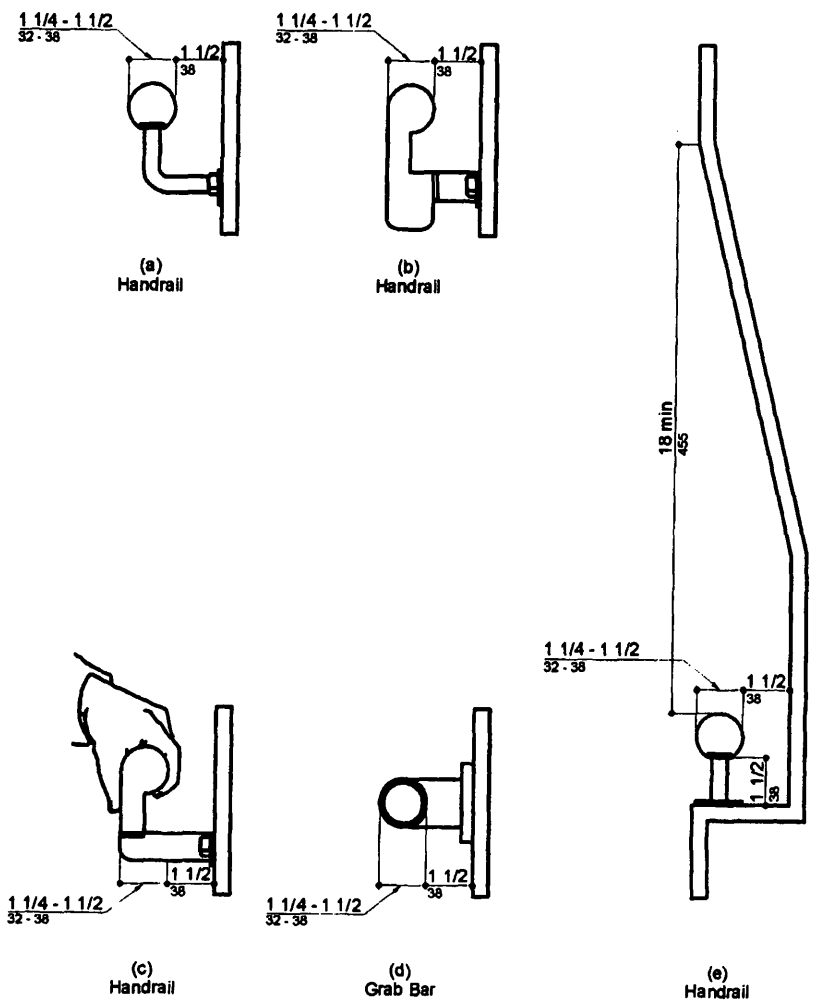
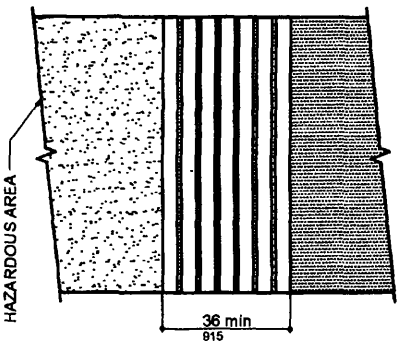
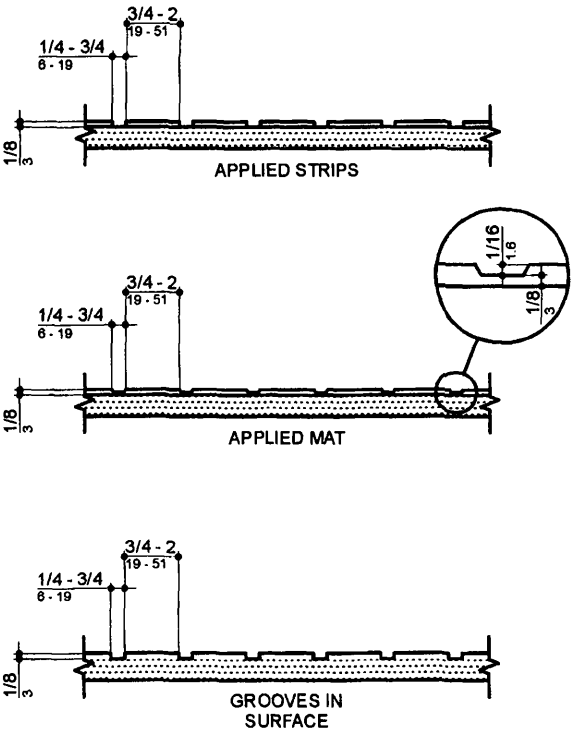


FIGURE 39
SIZE AND SPACING OF HANDRAILS AND GRAB BARS



(a) Plan of Detectable Warning Surface

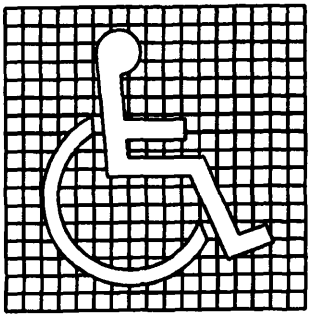
FIGURE 40 (A)
STRIPS AND GROOVES USED AS DETECTABLE WARNINGS ON WALKING SURFACES



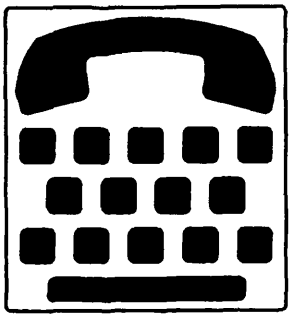
NOTE: Grooves may be used only indoors

(b) Sections of Detectable Warning Surfaces

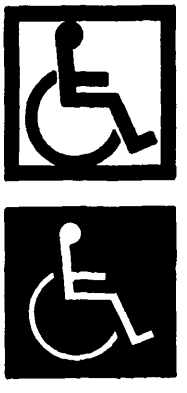
FIGURE 40 (B)
STRIPS AND GROOVES USED AS DETECTABLE WARNINGS ON WALKING SURFACES



(a) Proportions
International Symbol
of Accessibility



(c)
International TDD Symbol



(b)
Display Conditions
International Symbol
of Accessibility

(d)
International Symbol of
Access for Hearing Loss

FIGURE 43
INTERNATIONAL SYMBOLS

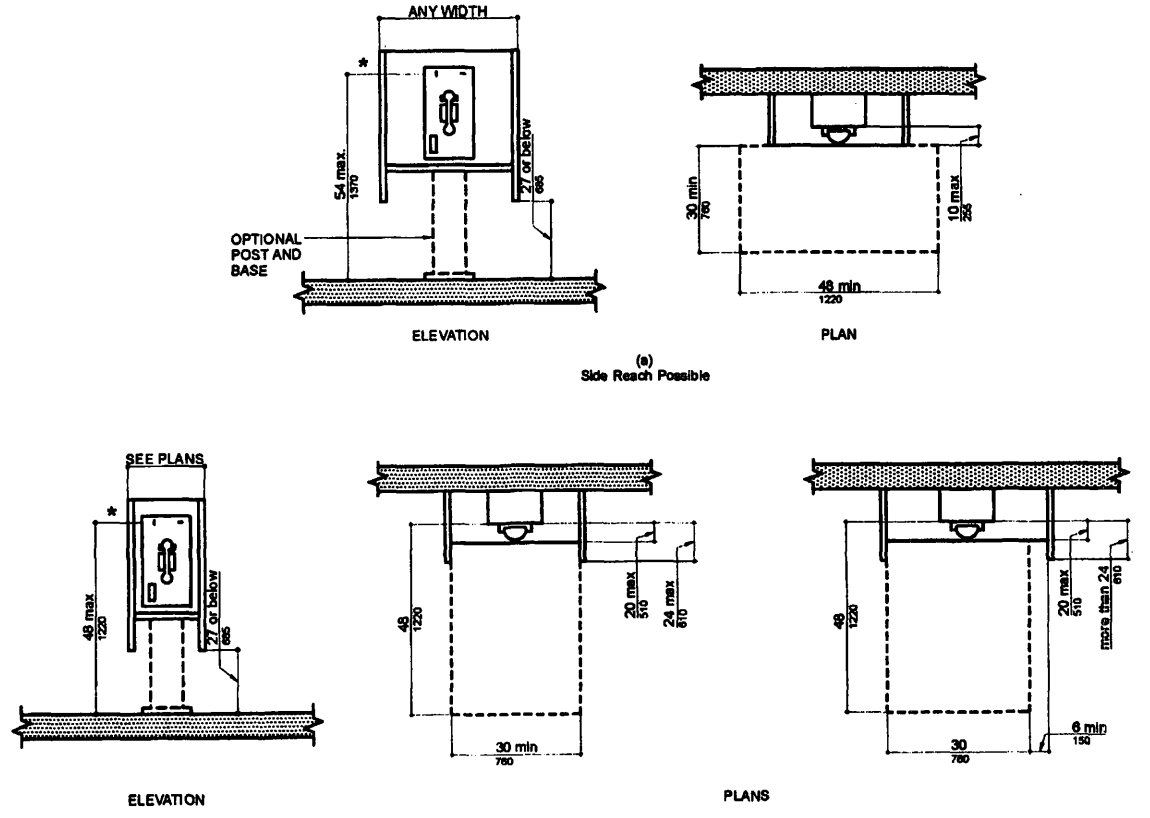


FIGURE 44
MOUNTING HEIGHTS AND CLEARANCES FOR TELEPHONES

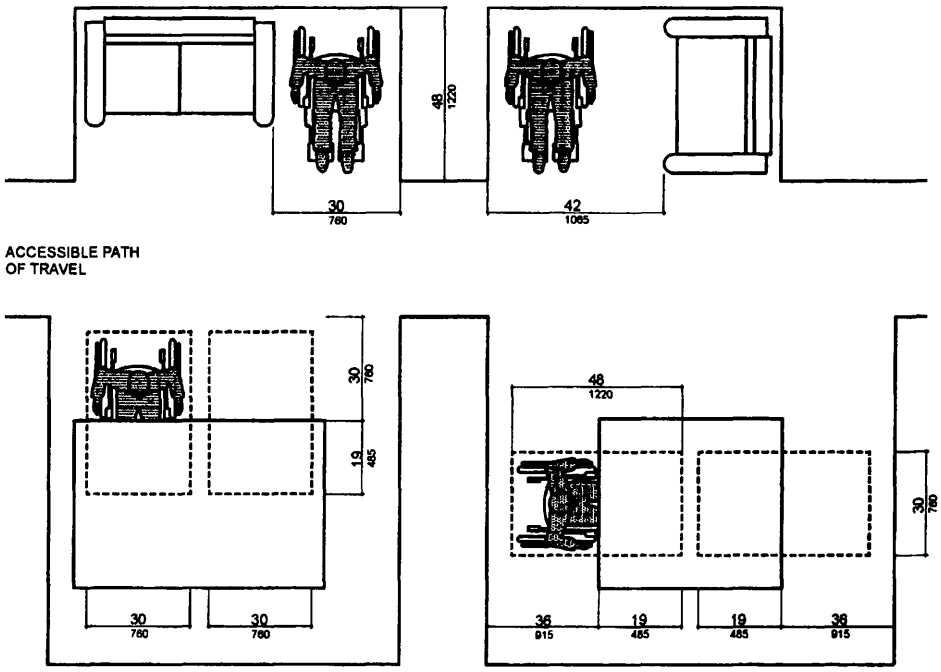


FIGURE 45
MINIMUM CLEARANCES FOR SEATING AND TABLES

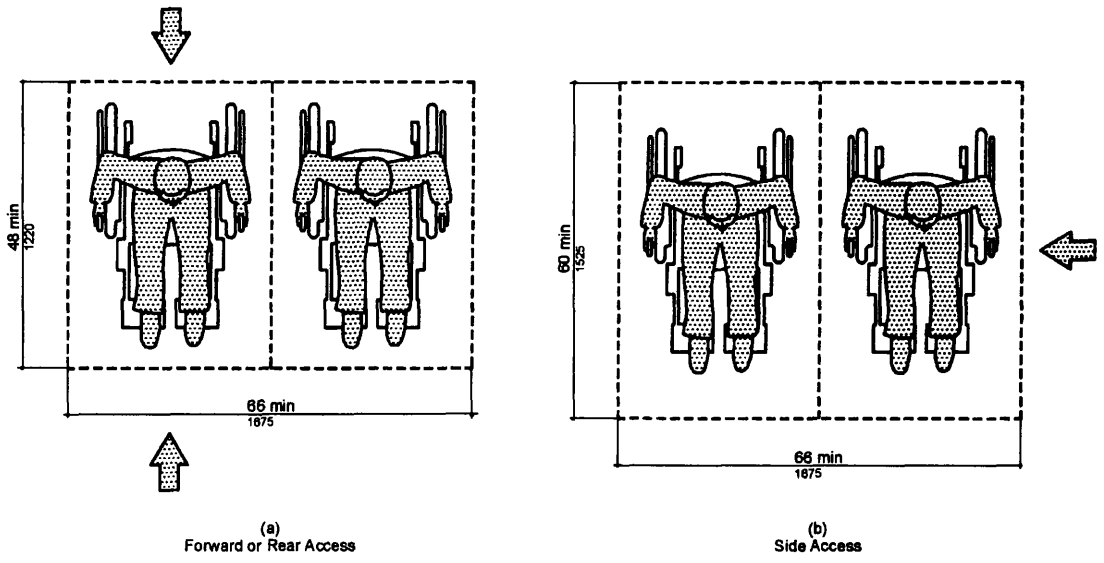


FIGURE 46
SPACE REQUIREMENTS FOR WHEELCHAIR SEATING SPACES IN SERIES

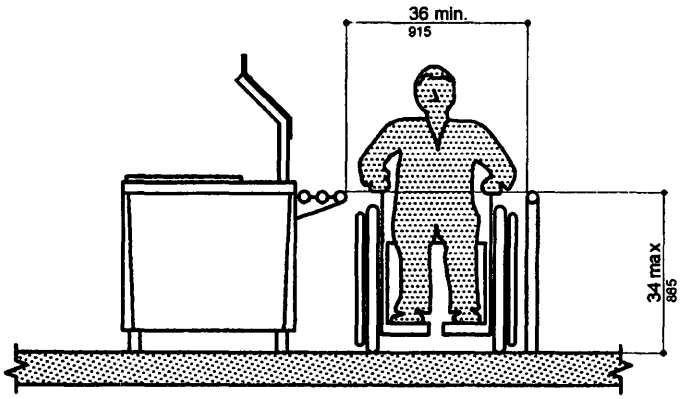


FIGURE 53
FOOD SERVICE LINES

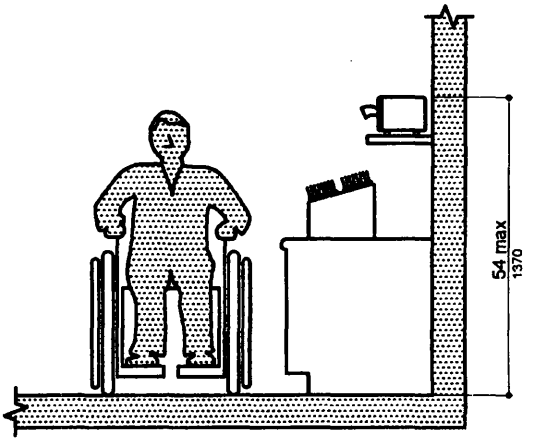


FIGURE 54
TABLEWARE AREAS

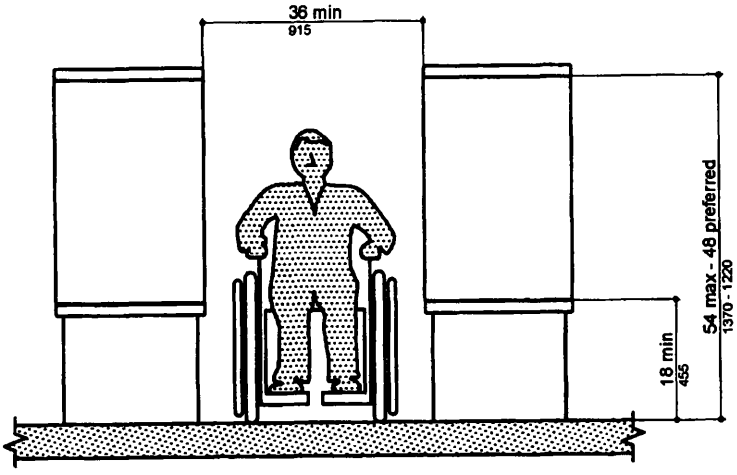


FIGURE 55
CARD CATALOG

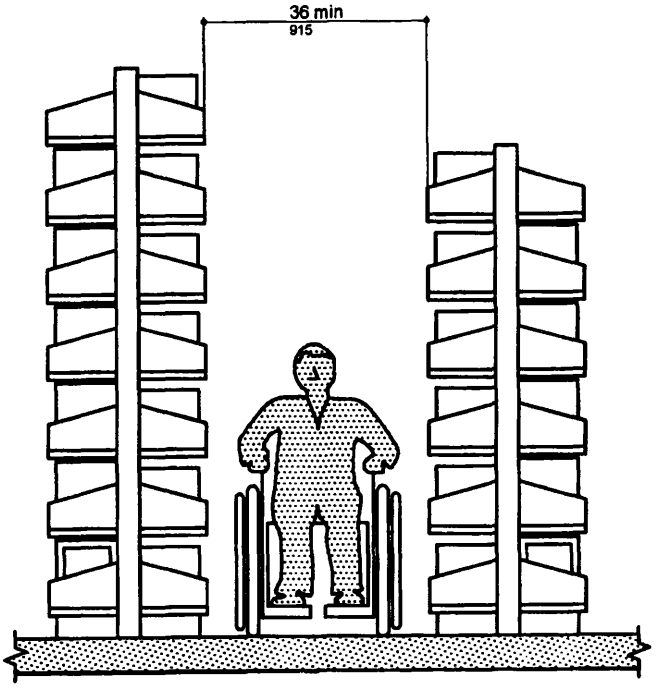


FIGURE 56
STACKS

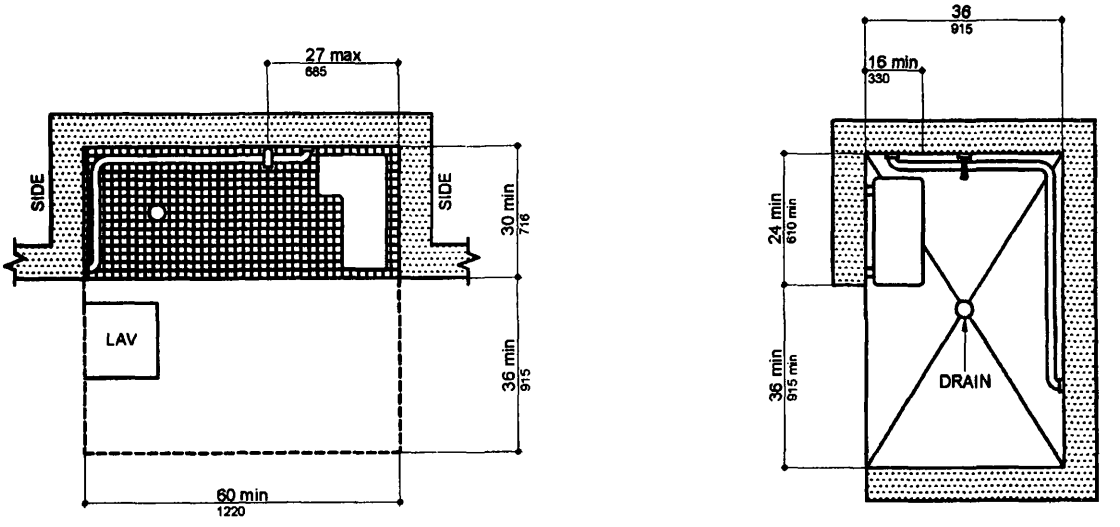


FIGURE 57
ROLL-IN SHOWER WITH FOLDING SEAT

APPENDIX A

COMMENTARY - APPENDIX OF THE ADAAG

RESERVED

FAIR HOUSING ACCESSIBILITY GUIDELINES
PART B

Design Guidelines for Accessible/Adaptable Dwellings

Issued by the Department of Housing and Urban Development

The *Fair Housing Act Design Manual* is published by the Department of Housing and Urban Development to assist designers and builders in meeting the accessibility requirements of the Fair Housing Act. Copies of this publication are available from the HUD Customer Service Center at 1-800-767-7468.

NOTE: This is a reprint of the final Fair Housing Accessibility Guidelines published in the Federal Register on March 6, 1991, Vol. 56, No. 44, pages 9472-9515. This reprint incorporates corrections to the final guidelines, which were published in the Federal Register on June 24, 1991.

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Requirement 3. Usable doors.
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FAIR HOUSING ACCESSIBILITY GUIDELINES

Section 1. Introduction

Authority

Section 804(f)(5)(C) of the Fair Housing Amendments Act of 1988 directs the Secretary of the Department of Housing and Urban Development to provide technical assistance to States, local governments, and other persons in implementing the accessibility requirements of the Fair Housing Act. These guidelines are issued under this statutory authority.

Purpose

The purpose of these guidelines is to provide technical guidance on designing dwelling units as required by the Fair Housing Amendments Act of 1988 (Fair Housing Act). These guidelines are not mandatory, nor do they prescribe specific requirements which must be met, and which, if not met, would constitute unlawful discrimination under the Fair Housing Act. Builders and developers may choose to depart from these guidelines and seek alternate ways to demonstrate that they have met the requirements of the Fair Housing Act. These guidelines are intended to provide a safe harbor for compliance with the accessibility requirements of the Fair Housing Act.

Scope

These guidelines apply only to the design and construction requirements of 24 CFR 100.205. Compliance with these guidelines do not relieve persons participating in a Federal or Federally-assisted program or activity from other requirements, such as those required by Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) and the Architectural Barriers Act of 1968 (42 U.S.C. 4151-4157). Accessible design requirements for Section 504 are found at CFR Part 8. Accessible design requirements for the Architectural Barriers Act are found at 24 CFR Part 40.

Organization of Guidelines

The design guidelines are incorporated in Section 5 of this document. Each guideline cites the appropriate paragraph of HUD's regulation at 24 CFR 100-205; quotes from the regulation to identify the required design features, and states recommended specifications for each design feature.

Generally, these guidelines rely on the American National Standards Institute (ANSI) A117.1-1986, American National Standard for Buildings and Facilities-Providing Accessibility and Useability for Physically Handicapped People (ANSI Standard). Where the guidelines rely on sections of the ANSI Standard, the ANSI sections are cited. Only those sections of the ANSI Standard cited in the guidelines are recommended for compliance with 24 CFR 100.205. For those guidelines that differ from the ANSI Standard, recommended specifications are provided. The texts of cited ANSI sections are not reproduced in the guidelines. The complete text of the 1986 version of the ANSI A117.1 Standard may be purchased from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

Section 2. Definitions

As used in these Guidelines:

"Accessible", when used with respect to the public and common use areas of a building containing covered multifamily dwellings, means that the public or common use areas of the building can be approached, entered, and used by individuals with physical handicaps. The phrase "readily accessible to and usable by" is synonymous with accessible. A public or common use area that complies with the appropriate requirements of ANSIA117.1-1986, a comparable standard or these guidelines is "accessible" within the meaning of this paragraph.

"Accessible route" means a continuous unobstructed path connecting accessible elements and spaces in a building or within a site that can be negotiated by a person with a severe disability using a wheelchair, and that is also safe for and usable by people with other disabilities. Interior accessible routes may include corridors, floors, ramps, elevators and lifts. Exterior accessible routes may include parking access aisles, curb ramps, walks, ramps and lifts. A route that complies with the appropriate requirements of ANSI A117.1-1986, a comparable standard, or SectionFHAG-5, Requirement 1 of these guidelines is an "accessible route". In the circumstances described in SectionFHAG-5, Requirements 1 and 2, "accessible route" may include access via a vehicular route.

"Adaptable dwelling units", when used with respect to covered multifamily dwellings, means dwelling units that include the features of adaptable design specified in 24 CFR 100.205(c)(2)-(3).

"ANSIA117/1-1086" means the 1986 edition of the American National Standard for buildings and facilities providing accessibility and usability for physically handicapped people.

"Assistive device" means an aid, tool, or instrument used by a person with disabilities to assist in activities of daily living. Examples of assistive devices include tongs, knob-turners, and oven-rack pusher/pullers.

"Bathroom", means a bathroom which includes a water closet (toilet), lavatory (sink), and bathtub or shower. It does not include single-fixture facilities or those with only a water closet and lavatory. It does include a compartmented bathroom. A compartmented bathroom is one in which the fixtures are distributed among interconnected rooms. A compartmented bathroom is considered a single unit and is subject to the Act's requirements for bathrooms.

"Building" means a structure, facility or portion thereof that contains or serves one or more dwelling units.

"Building entrance on an accessible route" means an accessible entrance to a building that is connected by an accessible route to public transportation stops, to parking or passenger loading zones, or to public streets or sidewalks, if available. A building entrance that complies with ANSIA117.1-1986 (see SectionFHAG-5, Requirement 1 of these guidelines) or a comparable standard complies with the requirements of this paragraph.

"Clear" means unobstructed.

"Common use areas" means rooms, spaces or elements inside or outside of a building that are made available for the use of residents of a building or the guests thereof. These areas include hallways, lounges, lobbies, laundry rooms, refuse rooms, mail rooms, recreational areas and passageways among and between buildings. See SectionFHAG-5, Requirement 2 of these guidelines.

"Controlled substance" means any drug or other substance, or immediate precursor included in the definition in Section 102 of the Controlled Substances Act (21 U.S.C. 802).

"Covered multifamily dwellings" or "covered multifamily dwellings subject to the Fair Housing Amendments" means buildings consisting of four or more dwelling units if such buildings have one or more elevators; and ground floor dwelling units in other buildings consisting of four or more dwelling units. Dwelling units within a single structure separated by firewalls do not constitute separate buildings.

"Dwelling unit" means a single unit of residence for a household of one or more persons. Examples of dwelling units covered by these guidelines include: condominiums; an apartment unit within an apartment building; and other types of dwellings in which sleeping accommodations are provided but toileting or cooking facilities are shared by occupants of more than one room or portion of the dwelling. Examples of the latter include dormitory rooms and sleeping accommodations in shelters intended for occupancy as a residence for homeless persons.

"Entrance" means any exterior access point to a building or portion of a building used by residents for the purpose of entering. For purposes of these guidelines, an "entrance" does not include a door to a loading dock or a door used primarily as a service entrance, even if nonhandicapped residents occasionally use that door to enter.

"Finished grade" means the ground surface of the site after all construction, levelling, grading, and development has been completed.

"Ground floor" means a floor of a building with a building entrance on an accessible route. A building may have one or more ground floors. Where the first floor containing dwelling units in a building is above grade, all units on

that floor must be served by a building entrance on an accessible route. This floor will be considered to be a ground floor.

"Handicap" means, with respect to a person, a physical or mental impairment which substantially limits one or more major life activities; a record of such an impairment; or being regarded as having such an impairment. This term does not include current, illegal use of or addiction to a controlled substance. For purposes of these guidelines, an individual shall not be considered to have a handicap solely because that individual is a transvestite.

As used in this definition:

(a) "Physical or mental impairment" includes:

(1) Any physiological disorder or condition, cosmetic disfigurement, or anatomical loss affecting one or more of the following body systems: Neurological; musculoskeletal; special sense organs; respiratory, including speech organs; cardiovascular; reproductive; digestive; genito-urinary; hemic and lymphatic; skin; and endocrine; or

(2) Any mental or psychological disorder, such as mental retardation, organic brain syndrome, emotional or mental illness, and specific learning disabilities. The term "physical or mental impairment" includes, but is not limited to, such diseases and conditions as orthopedic, visual, speech and hearing impairments, cerebral palsy, autism, epilepsy, muscular dystrophy, multiple sclerosis, cancer, heart disease, diabetes, Human Immunodeficiency Virus infection, mental retardation, emotional illness, drug addiction (other than addiction caused by current, illegal use of a controlled substance) and alcoholism. These guidelines are designed to make units accessible or adaptable for people with physical handicaps.

(b) "Major life activities" means functions such as caring for one's self, performing manual tasks, walking, seeing, hearing, speaking, breathing, learning and working.

(c) "Has a record of such an impairment" means has a history of, or has been misclassified as having, a mental or physical impairment that substantially limits one or more major life activities.

(d) "Is regarded as having an impairment" means:

(1) Has a physical or mental impairment that does not substantially limit one or more major life activities but that is treated by another person as constituting such a limitation;

(2) Has a physical or mental impairment that substantially limits one or more major life activities only as a result of the attitudes of others toward such impairment; or

(3) Has none of the impairments defined in paragraph (a) of this definition but is treated by another person as having such an impairment.

"Loft" means an intermediate level between the floor and ceiling of any story, located within a room or rooms of a dwelling.

"Multistory dwelling unit" means a dwelling unit with finished living space located on one floor and the floor or floors immediately above or below it.

"Public use areas" means interior or exterior rooms or spaces of a building that are made available to the general public. Public use may be provided at a building that is privately or publicly owned.

"Single-story dwelling unit" means a dwelling unit with all finished living space located on one floor.

"Site" means a parcel of land bounded by a property line or a designated portion of a public right of way.

"Slope" means the relative steepness of the land between two points and is calculated as follows: The distance and elevation between the two points (e.,g., an entrance and a passenger loading zone) are determined from a topographical map. The difference in elevation is divided by the distance and that fraction is multiplied by 100 to obtain a percentage slope figure. For example, if a principal entrance is ten feet from a passenger loading zone, and the principal entrance is raised one foot higher than the passenger loading zone, then the slope is 1/10 x 100 = 10%.

"Story" means that portion of a dwelling unit between the upper surface of any floor and the upper surface of the floor next above, or the roof of the unit. Within the context of dwelling units, the terms "story" and "floor" are synonymous.

"Undisturbed site" means the site before any construction, levelling, grading, or development associated with the current project.

"Vehicular or pedestrian arrival points" means public or resident parking areas, public transportation stops, passenger loading zones, and public streets or sidewalks.

"Vehicular route" means a route intended for vehicular traffic, such as a street, driveway or parking lot.

Section 3. Fair Housing Act Design and Construction Requirements

The regulations issued by the Department at 24 CFR 100/205 state:

Section100.205 Design and construction requirements.

(a) Covered multifamily dwellings for first occupancy after March 13, 1991, shall be designed and constructed to have at least one building entrance on an accessible route unless it is impractical to do so because of the site. For purposes of this section, a covered multifamily dwelling shall be deemed to be designed and constructed for first occupancy on or before March 13, 1991, if they are occupied by that date or if the last building permit or renewal thereof for the covered multifamily dwellings is issued by a State, County or local government on or before January 13, 1990. The burden of establishing impracticality because of terrain or unusual site characteristics is on the person or persons who designed or constructed the housing facility.

(b) The application of paragraph (a) of this section may be illustrated by the following examples:

Example (1): A real estate developer plans to construct six covered multifamily dwelling units on a site with a hilly terrainches Because of the terrain it will be necessary to climb a long and steep stairway in order to enter the dwellings. Since there is no practical way to provide an accessible route to any of the dwellings, one need not be provided.

Example (2): A real estate developer plans to construct a building consisting of 10 units of multifamily housing on a waterfront site that floods frequently. Because of this unusual characteristic of the site, the builder plans to construct the building on stilts. It is customary for housing in the geographic area where the site is located to be built on stilts. The housing may lawfully be constructed on the proposed site on stilts even though this means that there will be no practical way to provide an accessible route to the building entrance.

Example (3): A real estate developer plans to construct a multifamily housing facility on a particular site. The developer would like the facility to be built on the site to contain as many units as possible. Because of the configuration and terrain of the site, it is possible to construct a building with 105 units on the site provided the site does not have an accessible route leading to the building entrance. It is also possible to construct a building on the site with an accessible route leading to the building entrance. However, such a building would have no more than 100 dwelling units. The building to be constructed on the site must have a building entrance on an accessible route because it is not impractical to provide such an entrance because of the terrain or unusual characteristics of the site.

(c) All covered multifamily dwellings for first occupancy after March 13, 1991, with a building entrance on an accessible route shall be designed and constructed in such a manner that—

M(1) The public and common use areas are readily accessible to and usable by handicapped persons;

(2) All the doors designed to allow passage into and within all premises are sufficiently wide to allow passage by handicapped persons in wheelchairs; and

(3) All premises within covered multifamily dwelling units contain the following features of adaptable design:

(i) An accessible route into and through the covered dwelling unit;

(ii) Light switches, electrical outlets, thermostats, and other environmental controls in accessible locations:

(iii) Reinforcements in bathroom walls to allow later installation of grab bars around the toilet, tub, shower, stall and shower seal, where such facilities are provided; and

(iv) Usable kitchen and bathrooms such that an individual in a wheelchair can maneuver about the space.

(d) The application of Paragraph (c) of this section may be illustrated by the following examples:

Example (1): A developer plans to construct a 100 unit condominium apartment building with one elevator. In accordance with Paragraph (a), the building has at least one accessible route leading to an accessible entrance. All 100 units are covered multifamily dwelling units and they all must be designed and constructed so that they comply with the accessibility requirements of Paragraph (c) of this section.

Example (3): A developer plans to construct 30 garden apartments in a three story building. The building will not have an elevator. The building will have one accessible entrance which will be on the first floor. Since the building does not have an elevator only the "ground floor" units are covered multifamily units. The "ground floor" is the first floor because that is the floor that has an accessible entrance. All of the dwelling units on the first floor must meet the accessibility requirements of Paragraph (c) of this section and must have access to at least one of each type of public or common use area available for residents in the building.

(e) Compliance with the appropriate requirements of ANSI A117.1-1986 suffices to satisfy the requirements of Paragraph (c)(3) of this section.

(f) Compliance with a duly enacted law of a State or unit of general local government that includes the requirements of Paragraphs (a) and (c) of this section satisfies the requirements of Paragraphs (a) and (c) of this section.

(g)(1) It is the policy of HUD to encourage States and units of general local government to include, in their existing procedures for the review and approval of newly constructed covered multifamily dwellings, determinations as to whether the design and construction of such dwellings are consistent with Paragraphs (a) and (c) of this section.

(2) A State or unit of general local government may review and approve newly constructed multifamily dwellings for the purpose of making determinations as to whether the requirements of Paragraphs (a) and (c) of this section are met.

(h) Determinations of compliance or noncompliance by a State or a unit of general local government under Paragraph (f) or (g) of this section are not conclusive in enforcement proceedings under the Fair Housing Amendments Act.

(i) This subpart does not invalidate or limit any law of a State or political subdivision of a State that requires dwellings to be designed and constructed in a manner that affords handicapped persons greater access than is required by this subpart.

Section 4. Application of the Guidelines

The design specifications (guidelines) presented in SectionFHAG-5 apply to new construction of "covered multifamily dwellings", as defined in SectionFHAG-2. These guidelines are recommended for designing dwellings that comply with the requirements of the Fair Housing Amendments Act of 1988.

Section 5. Guidelines

Requirement 1. Accessible building entrance on an accessible route.

Under Section 100.205(a), covered multifamily dwellings shall be designed and constructed to have at least one building entrance on an accessible route, unless it is impractical to do so because of terrain or unusual characteristics of the site.

Guideline

(1) Building entrance. Each building on a site shall have at least one building entrance on an accessible route unless prohibited by the terrain, as provided in Paragraphs (2)(a)(i) or (2)(a)(ii), or unusual characteristics of the site, as provided in Paragraph (2)(b). This guideline applies both to a single building on a site and to multiple buildings on a site.

(a) Separate ground floor unit entrances. When a ground floor unit of a building has a separate entrance, each such ground floor unit shall be served by an accessible route, except for any unit where the terrain or unusual characteristics of the site prohibit the provision of an accessible route to the entrance of that unit.

(b) Multiple entrances. Only one entrance is required to be accessible to any one ground floor of a building, except in cases where an individual dwelling unit has a separate exterior entrance, or where the building contains clusters of dwelling units, with each cluster sharing a different exterior entrance. In these cases, more than one entrance may be required to be accessible, as determined by analysis of the site. In every case, the accessible entrance should be on an accessible route to the covered dwelling units it serves.

(2) Site impracticality. Covered multifamily dwellings with elevators shall be designed and constructed to provide at least one accessible entrance on an accessible route, regardless of terrain or unusual characteristics of the site. Covered multifamily dwellings without elevators shall be designed and constructed to provide at least one accessible entrance on an accessible route unless terrain or unusual characteristics of the site are such that the following conditions are found to exist:

(a) Site impracticality due to terrain. There are two alternative tests for determining site impracticality due to terrain: the individual building test provided in paragraph (i), or the site analysis test provided in paragraph (ii). These tests may be used as follows.

A site with a single building having a common entrance for all units may be analyzed only as described in paragraph (i).

All other sites, including a site with a single building having multiple entrances serving either individual dwelling units or clusters of dwelling units, may be analyzed using the methodology in either Paragraph (i) or Paragraph (ii). For these sites for which either test is applicable, regardless of which test is selected, at least 20% of the total ground floor units in nonelevator buildings, on any site, must comply with the guidelines.

(i) Individual building test. It is impractical to provide an accessible entrance served by an accessible route when the terrain of the site is such that:

(A) The slopes of the undisturbed site measured between the planned entrance and all vehicular or pedestrian arrival points within 50 feet of the planned entrance exceed 10 percent; and

(B) the slopes of the planned finished grade measured between the entrance and all vehicular or pedestrian arrival points within 50 feet of the planned entrance also exceed 10 percent.

If there are no vehicular or pedestrian arrival points within 50 feet of the planned entrance, the slope for the purposes of this Paragraph (i) will be measured to the closest vehicular or pedestrian arrival point.

For purposes of these guidelines, vehicular or pedestrian arrival points include public or resident parking areas; public transportation stops; passenger loading zones; and public streets or sidewalks. To determine site impracticality, the slope would be measured at ground level from the point of the planned entrance on a straight line to (i) each vehicular or pedestrian arrival point that is within 50 feet of the planned entrance, or (ii) if there are no vehicular or pedestrian arrival points within that specified area, the vehicular or pedestrian arrival point closest to the planned entrance. In the case of sidewalks, the closest point to the entrance will be where a public sidewalk entering the site intersects with the sidewalk to the entrance. In the case of resident parking areas, the closest point to the planned entrance will be measured from the entry point to the parking area that is located closest to the planned entrance.

(ii) Site analysis test. Alternatively, for a site having multiple buildings, or a site with a single building with multiple entrances, impracticality of providing an accessible entrance served by an accessible route can be established by the following steps:

(A) The percentage of the total buildable area of the undisturbed site with a natural grade less than 10% slope shall be calculated. The analysis of the existing slope (before grading) shall be done on a topographic survey with two foot (2') contour intervals with slope determination made between each successive interval. The accuracy of the slope analysis shall be certified by a professional licensed engineer, landscape architect, architect or surveyor.

(B) To determine the practicality of providing accessibility to planned multifamily dwellings based on the topography of the existing natural terrain, the minimum percentage of ground floor units

to be made accessible should equal the percentage of the total buildable area (not including floodplains, wetlands, or other restricted use areas) of the undisturbed site that has an existing natural grade of less than 10% slope.

(C) In addition to the percentage established in paragraph (B), all ground floor units in a building, or ground floor units served by a particular entrance, shall be made accessible if the entrance to the units is on an accessible route, defined as a walkway with a slope between the planned entrance and a pedestrian or vehicular arrival point that is no greater than 8.33%.

(b) Site impracticality due to unusual characteristics. Unusual characteristics include sites located in a federally-designated floodplain or coastal high-hazard area and sites subject to other similar requirements of law or code that the lowest floor or the lowest structural member of the lowest floor must be raised to a specified level at or above the base flood elevation. An accessible route to a building entrance is impractical due to unusual characteristics of the site when:

(i) the unusual site characteristics result in a difference in finished grade elevation exceeding 30 inches and 10 percent measured between an entrance and all vehicular or pedestrian arrival points within 50 feet of the planned entrance; or

(ii) if there are no vehicular or pedestrian arrival points within 50 feet of the planned entrance, the unusual characteristics result in a difference in finished grade elevation exceeding 30 inches and 10 percent measured between an entrance and the closest vehicular or pedestrian arrival point.

(3) Exceptions to site impracticality. Regardless of site considerations described in paragraphs (1) and (2), an accessible entrance on an accessible route is practical when:

(a) There is an elevator connecting the parking area with the dwelling units on a ground floor. (In this case, those dwelling units on the ground floor served by an elevator, and at least one of each type of public and common use areas, would be subject to these guidelines.) However:

(i) Where a building elevator is provided only as a means of creating an accessible route to dwelling units on a ground floor, the building is not considered an elevator building for purposes of these guidelines; hence, only the ground floor dwelling units would be covered.

(ii) If the building elevator is provided as a means of access to dwelling units other than dwelling units on a ground floor, then the building is an elevator building which is a covered multifamily dwelling, and the elevator in that building must provide accessibility to all dwelling units in the building, regardless of the slope of the natural terrain; or

(b) An elevated walkway is planned between a building entrance and a vehicular or pedestrian arrival point and the planned walkway has a slope no greater than 10 percent.

(4) Accessible entrance. An entrance that complies with ANSI 4.14 meets Section 100.205(a).

(5) Accessible route. An accessible route that complies with ANSI 4.3 would meet Section 100.205(a). If the slope of the finished grade between covered multifamily dwellings and a public or common use facility (including parking) exceeds 8.33%, or where other physical barriers (natural or manmade) or legal restrictions, all of which are outside the control of the owner, prevent the installation of an accessible pedestrian route, an acceptable alternative is to provide access via a vehicular route, so long as necessary site provisions such as parking spaces and curb ramps are provided at the public or common use facility.

Requirement 2. Accessible and usable public and common use areas.

Section 100.205(c)(1) provides that covered multifamily dwellings with a building entrance on an accessible route shall be designed in such a manner that the public and common use areas are readily accessible to and usable by handicapped persons.

Guideline

The following chart identifies the public and common use areas that should be made accessible, cites the appropriate section of the ANSI Standard, and describes the appropriate application of the specifications, including modifications to the referenced standard.

	Accessible element or space	ANSI A117.1 Section	Application
1.	Accessible route(s)...	4.3	Within the boundary of the side: (a) From public transportation stops, accessible parking spaces, accessible passenger loading zones, and public streets or sidewalks to accessible building entrances (subject to site considerations described in Section 5). (b) Connecting accessible buildings, facilities, elements and spaces that are on the same site. On-grade walks or paths between separate buildings with covered multifamily dwellings, while not required, should be accessible unless the slope of finish grade exceeds 8.33% at any point along the route. Handrails are not required on these accessible walks. (c) Connecting accessible buildingor facility entrances with accessible spaces and elements within the building or facility, including adaptable dwelling units. (d) Where site or legal constraints prevent a route accessible to wheelchair users between covered multifamily dwellings and public or common-use facilities elsewhere on the site, an accept able alternative is the provision of access via a vehicular route so long as there is accessible parking on an accessible route to at least 2% of covered dwelling units and necessary site provisions such as parking and curb cuts are available at the public or common use facility.
2.	Protruding objects.....	4.4	Accessible routes or maneuvering space including floors, walks, ramps, stairs, and curb ramps.
3.	Ground and floor surface treatments....	4.5	Accessible routes, rooms, and spaces, including floors, walks, ramps, stairs, and curb ramps.
4.	Parking and passenger loading zones.....	4.6	If provided at the site, designated accessible parking at the dwelling unit on request of residents with handicaps on the same terms and with the full range of choices (e.g., surface parking or garage) that are provided for other residents of the project with accessible parking on a route accessible to wheelchairs for at least 2% of the covered dwelling units: accessible visitor parking sufficient to provide access to grade level entrances of covered multifamily dwellings; and accessible parking at facilities (e.g., swimming pools) that serve accessible buildings.
5.	Curb ramps	4.7	Accessible routes crossing curbs.
6.	Ramps	4.8	Accessible routes with slopes greater than 1:20.
7.	Stairs	4.9	Stairs on accessible routes connecting levels not connected by an elevator.
8.	Elevator	4.10	If provided.
9.	Platform lift	4.11	May be used in lieu of an elevator or ramp under certain conditions.
10.	Drinking fountains and water coolers	4.15	Fifty percent of fountains and coolers on each floor, or at least one, if provided in the facility or at the site.
11.	Drinking fountains and bathing facilities (including water closets, toilet rooms and stalls, urinals. Lavatories and mirrors, bathtubs, shower stalls, and sinks.)	4.22	Where provided in public-use and common-use facilities, at least one of each fixture provided per room.
12.	Seating, tables, or work surfaces	4.30	If provided in accessible spaces, at least one of each type provided.
13.	Places of assembly	4.31	If provided in the facility or at the site.
14.	Common-use spaces and facilities (including swimming pools, playgrounds, entrances, rental offices, lobbies, elevators, mailbox areas, lounges, halls and corridors, and the like.)	4.1 through 4.30	If provided in the facility or at the site: (a) Where multiple recreational facilities (e.g., tennis courts) are provided sufficient accessible facilities or each type to assure suitable opportunity for use by areas, lounges, persons with handicaps. (b) Where practical access to all or a portion of nature trails and jogging paths.
15.	Laundry rooms	4.32.6	If provided in the facility or at the site, at least one or each type of appliances provided in each laundry area, except that laundry rooms serving covered multiple-family dwellings would not be required to have front-loading washers in order to meet the requirements of 100.205(c)(1). (Where front-loading washers are not provided, management will be expected to provide assistive devices on request if necessary to permit a resident to use a top loading washer.)

Requirement 3. Usable doors.

Section 100.205(c)(2) provides that covered multifamily dwellings with a building entrance on an accessible route shall be designed in such a manner that all the doors designed to allow passage by handicapped persons in wheelchairs.

Guideline

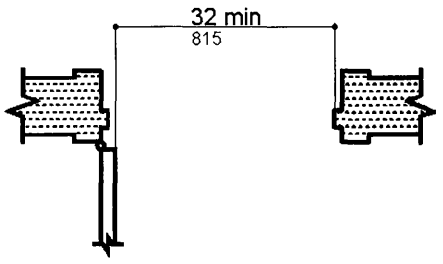
Section 100.205(c)(2) would apply to doors that are a part of an accessible route in the public and common use areas of multifamily dwellings and to doors into and within individual dwelling units.

(1) On accessible routes in public and common use areas,and for primary entry doors to covered units, doors that comply with ANSI 4.13 would meet this requirement.

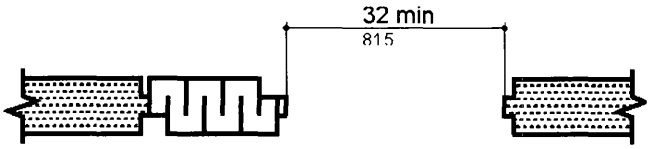
(2)Within individual dwelling units, doors intended for user passage through the unit which have a clear opening of at least 32 inches nominal width when the door is open 90degrees, measured between the face of the door and thestop, would meet this requirement. (See Fig. 1(a), (b), and (c).) Openings more than 24 inches in depth are not considered doorways. (See Fig. 1 (d).)

Note:

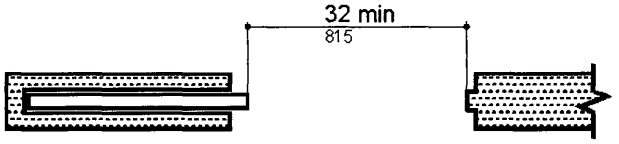
A 34-inch door, hung in the standard manner, provides an acceptable nominal 32-inch clear opening. This door can be adapted to provide a wider opening by using offset hinges, by removing lower portions of the door stop, or both. Pocket or sliding doors are acceptable doors in covered dwelling units and have the added advantage of not impinging on clear floor space in small rooms. The nominal 32-inch clear opening provided by a standard six-foot sliding patio door assembly is acceptable.



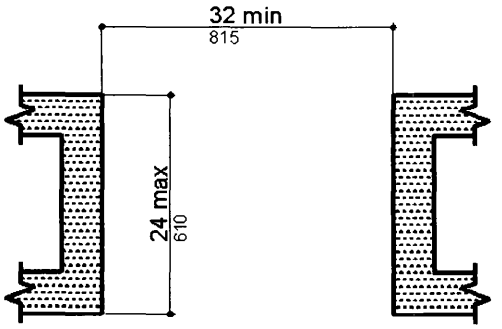
(a) Hinged Door



(b) Folding Door



(c) Sliding Door



(d) Maximum Doorway Depth

FIGURE 1
CLEAR DOORWAY WIDTH AND DEPTH

Requirement 4 - Accessible route into and through the covered dwelling unit.

Section 100.205(c)(3)(i) provides that covered multifamily dwellings with a building entrance on an accessible route shall be designed and constructed in such a manner that all premises within covered multifamily dwelling units contain an accessible route into and through the covered dwelling unit.

Guideline

Accessible routes into and through dwelling units would meet Section 100.205(c)(3)(i) if:

(1) A minimum clear width of 36 inches is provided.

(2) In single-story dwelling units, changes in level within the dwelling unit with heights between 1/4 inch and 1/2 inch are beveled with a slope no greater than 1:2. Except for design features, such as a loft or an area on a different level within a room (e.g., a sunken living room), changes in level greater than 12 inch are ramped or have other means of access. Where a single story dwelling unit has special design features, all portions of the single-story unit, except the loft or the sunken or raised area, are on an accessible route; and

(a) In single-story dwelling units with lofts, all spaces other than the loft are on an accessible route.

(b) Design features such as sunken or raised functional areas do not interrupt the accessible route through the remainder of the dwelling unit.

(3) In multistory dwelling units in buildings with elevators, the story of the unit that is served by the building elevator (a) is the primary entry to the unit, (b) complies with Requirements 2 through 7 with respect to the rooms located on the entry/accessible floor; and (c) contains a bathroom or powder room which complies with Requirement 7. (Note: multistory dwelling units in non-elevator buildings are not covered dwelling units because, in such cases, there is no ground floor unit).

(4) Except as provided in Paragraphs (5) and (6) below, thresholds at exterior doors, including sliding door tracks, are no higher than 3/4 inch. Thresholds and changes in level at these locations are beveled with a slope no greater than 1:2.

(5) Exterior deck, patio, or balcony surfaces are no more than 1/2 inch below the floor level of the interior of the dwelling unit, unless they are constructed of impervious material such as concrete, brick or flagstone. In such case the surface is no more than 4 inches below the floor level of the interior of the dwelling unit, or lower if required by local building code.

(6) At the primary entry door to dwelling units with direct exterior access, outside landing surfaces constructed of impervious materials such as concrete, brick or flagstone, are no more than 1/2 inch below the floor level of the interior of the dwelling unit. The finished surface of this area that is located immediately outside the entry may be sloped, up to 1/8 inch per foot (12 inches), for drainage.

Requirement 5 - Light switches, electrical outlets, thermostats and other environmental controls in accessible locations.

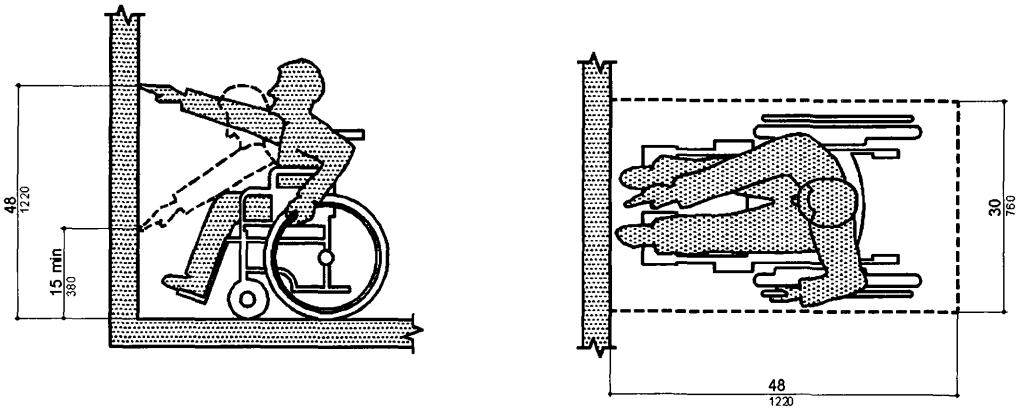
Section 100.205(c)(3)(ii) requires that all covered multifamily dwellings with a building entrance on an accessible route shall be designed and constructed in such a manner that all premises within covered multifamily dwelling unit contain light switches, electrical outlets, thermostats, and other environmental controls in accessible locations.

Guideline

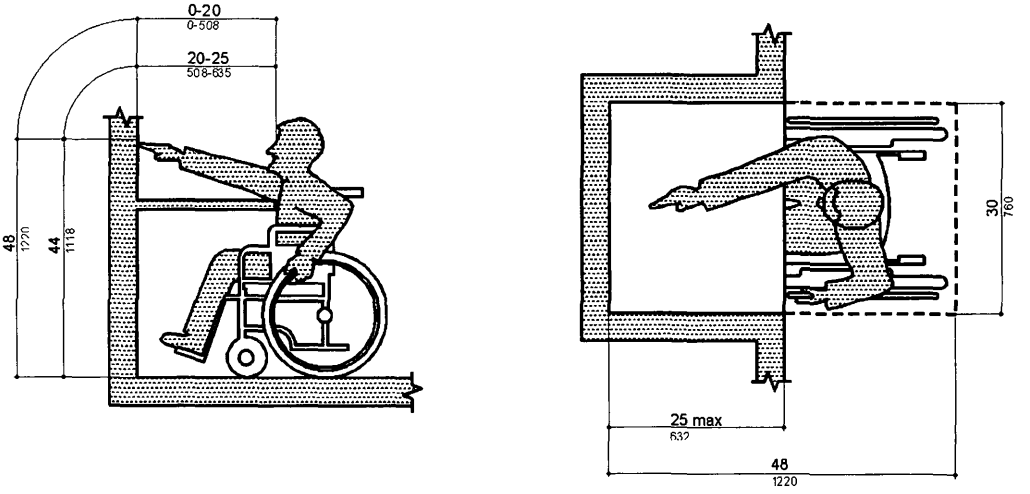
Light switches, electrical outlets, thermostats and other environmental controls would meet Section 100.205(c)(3)(ii) if operable parts of the controls are located no higher than 48 inches, and no lower than 15 inches, above the floor. If the reach is over an obstruction (for example, an overhanging shelf) between 20 and 25 inches in depth, the maximum height is reduced to 44 inches for forward approach; or 46 inches for side approach, provided the obstruction (for example, a kitchen base cabinet) is no more than 24 inches in depth. Obstructions should not extend more than 25 inches from the wall beneath a control (See Figure FHAG-2.)

Note:

Controls or outlets that do not satisfy these specifications are acceptable provided that comparable controls or outlets (i.e., that perform the same functions) are provided within the same area and are accessible, in accordance with this guideline for Requirement 5.

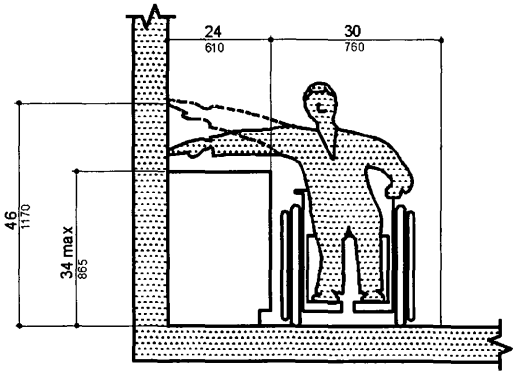


(a)
Forward Reach Limit



NOTE: Clear knee space should be as deep as the reach distance

(b)
Maximum Forward Reach Over an Obstruction



(c)
Maximum Side Reach Over Obstruction

FIGURE 2
REACH RANGES

Requirement 6 - Reinforced walls for grab bars.

Section 100.205(c)(3)(iii)requires that covered multifamily dwellings with a building entrance on an accessible route shall be designed and constructed in such a manner that all premises within covered multifamily dwelling units contain reinforcements in bathroom walls to allow later installation of grab bars around toilet, tub, shower stall and shower seat, where such facilities are provided.

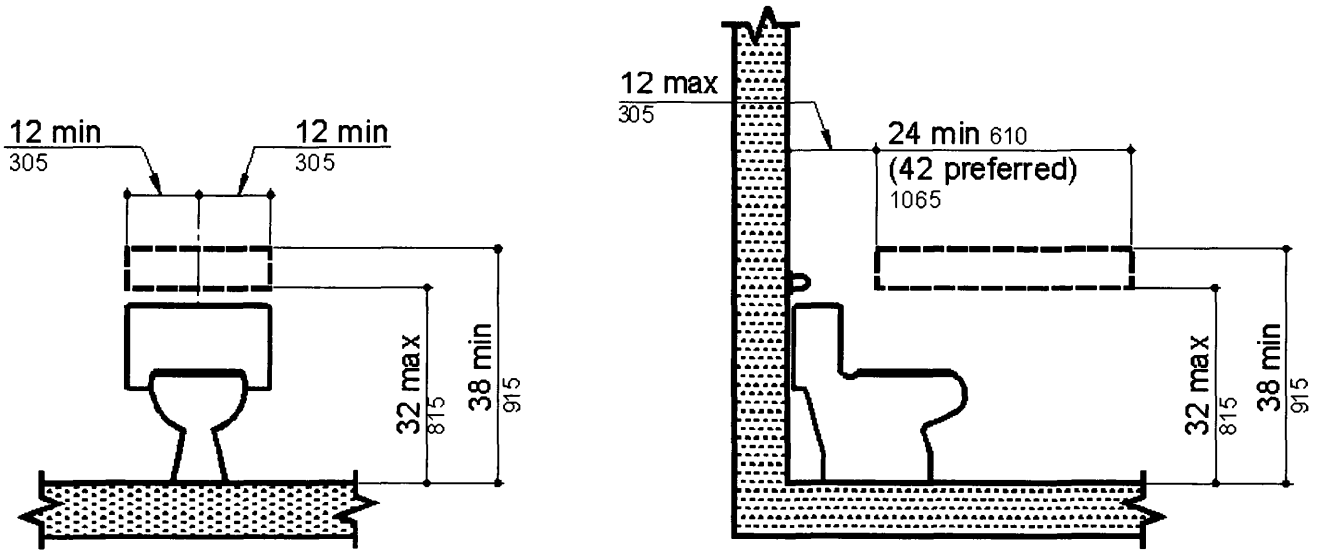
Guideline

Reinforced bathroom walls to allow later installation of grab bars around the toilet, tub, shower stall and shower seat, where such facilities are provided, would meet Section 100.205(c)(3)(iii) if reinforced areas are provided at least at those points where grab bars will be mounted. (For example, see Fig. 3, 4 and 5.) Where the toilet is not placed adjacent to a side wall, the bathroom would comply if provision was made for installation of floor mounted, foldaway or similar alternative grab bars. Where the power room (a room with a toilet and sink) is the only toilet facility located on an accessible level of a multistory dwelling unit, it must comply with this requirement for reinforced walls for grab bars.

Note:

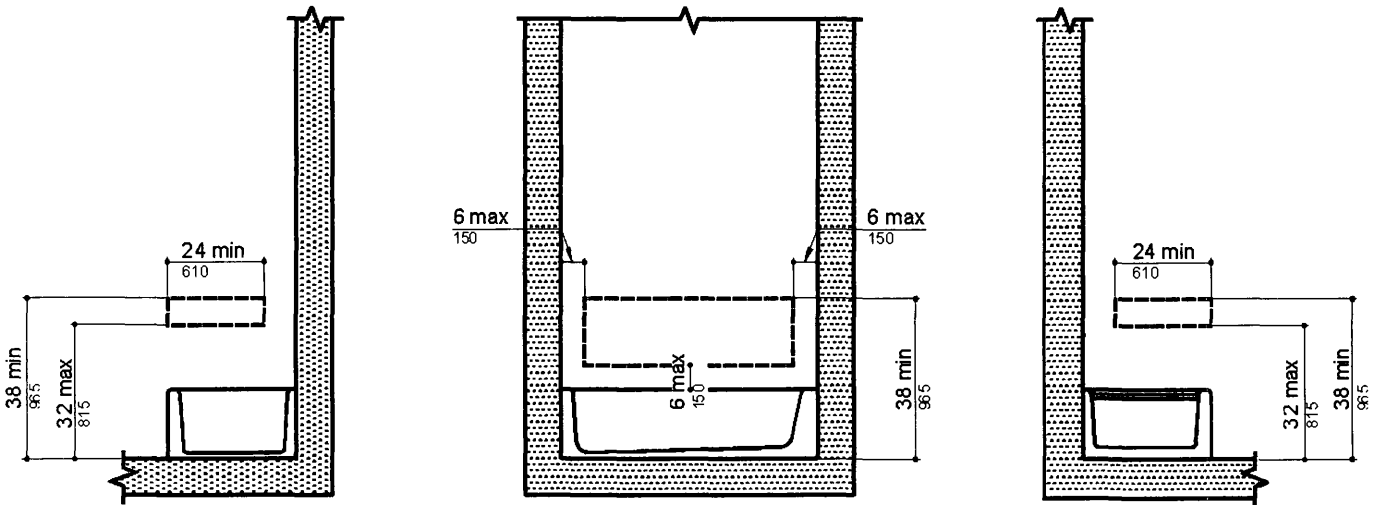
Installation of bathtubs is not limited by the illustrative figures; a tub may have shelves or benches at either end; or a tub may be installed without surrounding walls, if there is provision for alternative mounting of grab bars. For example, a sunken tub placed away from walls could have reinforced areas for installation of floor-mounted grab bars. The same principle applies to shower stalls - e.g., glass-walled stalls could be planned to allow floor-mounted grab bars to be installed later.

Reinforcement for grab bars may be provided in a variety of ways (for example, by plywood or wood blocking) so long as the necessary reinforcement is placed so as to permit later installation of appropriate grab bars.



Reinforced areas for installation
of Grab Bars

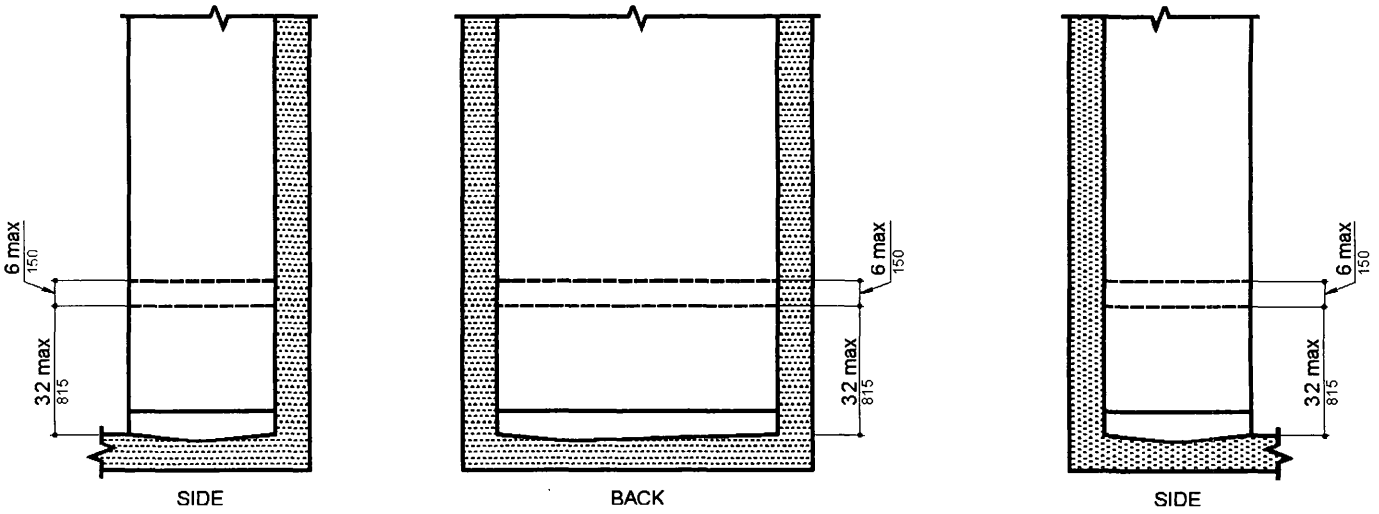
FIGURE 3
WATER CLOSETS IN ADAPTABLE BATHROOMS



NOTE: The areas outlined in dashed lines represent locations for future installation of grab bars for typical fixture configurations.

FIGURE 4
LOCATION OF GRAB BAR REINFORCEMENTS FOR ADAPTABLE BATHTUBS

NOTE: The areas outlined in dashed lines represent locations for future installations of grab bars for typical fixture configurations.



NOTE: The areas outlined in dashed lines represent locations for future installation of grab bars

FIGURE 5
LOCATION OF GRAB BAR REINFORCEMENTS FOR ADAPTABLE SHOWERS

NOTE: The areas outlined in dashed lines represent locations for future installations of grab bars.

Requirement 7 - Usable kitchens and bathrooms.

Section 100.205(c)(3)(iv) requires that covered multifamily dwellings with a building entrance on an accessible route shall be designed and constructed in such a manner that all premises within covered multifamily dwelling units contain usable kitchens and bathrooms such that an individual in a wheelchair can maneuver about the space.

Guideline

(1) Usable kitchens. Usable kitchens would meet Section 100.205(c)(3)(iv) if:

(a) A clear floor space at least 30 inches by 48 inches that allows a parallel approach by a person in a wheelchair is provided at the range or cooktop and sink and either a parallel or forward approach is provided at oven, dish washer, refrigerator/freezer or trash compactor. (See Figure FHAG-6)

(b) Clearance between counters and all opposing base cabinets, countertops, appliances or walls is at least 40 inches.

(c) In U-shaped kitchens with sink or range or cooktop at the base of the "U", a 60-inch turning radius is provided to allow parallel approach, or base cabinets are removable at that location to allow knee space for a forward approach.

(2) Usable bathrooms. To meet the requirements of Section 100.205(c)(3)(iv) either.

All bathrooms in the dwelling unit comply with option 2, or the provisions of Paragraph (a): or

At least one bathroom in the dwelling unit complies with the provisions of Paragraph (b), and all other bathrooms and powder rooms within the dwelling unit must be on an accessible route with usable entry doors in accordance with the guidelines for Requirements 3 and 4.

However, in multistory dwelling units, only those bathrooms on the accessible level are subject to the requirements of Section 100.205(c)(3)(accessibility). Where a powder room is the only facility provided on the accessible level of a multistory dwelling unit, the powder room must comply with provisions of Paragraph (a) or Paragraph (b). Powder rooms that are subject to the requirements of Section 100.205(c)(3)(iv) must have reinforcements for grab bars as provided in the guideline for Requirement 6.

(a) Bathrooms that have reinforced walls for grab bars (see Requirement 6) would meet Section 100.205(c)(3)(iv) if:

(i) Sufficient maneuvering space is provided within the bathroom for a person using a wheelchair or other mobility aid to enter and close the door, use the fixtures, reopen the door and exit. Doors may swing into the clear floor space provided at any fixture if the maneuvering space is provided. Maneuvering spaces may include any kneespace or toespace available below bathroom fixtures.

(ii) Clear floor space is provided at fixtures as shown in Figure FHAG-7(a), Figure FHAG-7(b), Figure FHAG-7(c) and Figure FHAG-7(d). Clear floor space at fixtures may overlap.

(iii) If the shower stall is the only bathing facility provided in the covered dwelling unit, the shower stall measures at least 36 inches x 36 inches.

Note:

Cabinets under lavatories are acceptable provided the bathroom has space to allow a parallel approach by a person in a wheelchair; if parallel approach is not possible within the space, any cabinets provided would have to be removable to afford the necessary knee clearance for forward approach.

(b) Bathrooms that have reinforced walls for grab bars (see Requirement 6) would meet Section 100.205(c)(3)(iv) if:

(i) Where the door swings into the bathroom, there is a clear space (approximately 2'6" by 4'0") within the room to position a wheelchair or other mobility aid clear of the path of the door as it is closed and to permit use of fixtures. This clear space can include any kneespace and toespace available below bathroom fixtures.

(ii) Where the door swings out, a clear space is provided within the bathroom for a person using a wheelchair or other mobility aid to position the wheelchair such that the person is allowed use of fixtures. There also shall be clear space to allow persons using wheelchairs to reopen the door to exit.

(iii) When both tub and shower fixtures are provided in the bathroom, at least one is made accessible. When two or more lavatories in a bathroom are provided, at least one is made accessible.

(iv) Toilets are located within bathrooms in a manner that permit a grab bar to be installed on one side of the fixture. In locations where toilets are adjacent to walls or bathtubs, the center line of the fixture is a minimum of 1'6" from the obstacle. The other (non-grab bar) side of the toilet fixture is a minimum of 1'3" from the finished surface of adjoining walls, vanities or from the edge of a lavatory. (See Figure FHAG-7(a).

(v) Vanities and lavatories are installed with the centerline of the fixture a minimum of 1'3" horizontally from an adjoining wall or fixture. The top of the fixture rim is a maximum height of 2'10" above the finished floor. If kneespace is provided below the vanity, the bottom of the apron is at least 2'3" above the floor. If provided, full kneespace (for front approach) is at least 1'5" deep. (See Figure FHAG-7(c).)

(vi) Bathtubs and tub/showers located in the bathroom provide a clear access aisle adjacent to the lavatory that is at least 2'6" wide and extends for a length of 4'0" (measured from the foot of the bathtub). (See Figure FHAG-8.)

(vii) Stall showers in the bathroom may be of any size or configuration. A minimum clear floor space 2'6" wide by 4'0" should be available outside the stall. (See Figure FHAG-7(d).) If the shower stall is the only bathing facility provided in the covered dwelling unit, or on the accessible level of a covered multistory unit, and measures a nominal 36 x 36, the shower stall must have reinforcing to allow for installation of an optional wall hung bench seat.

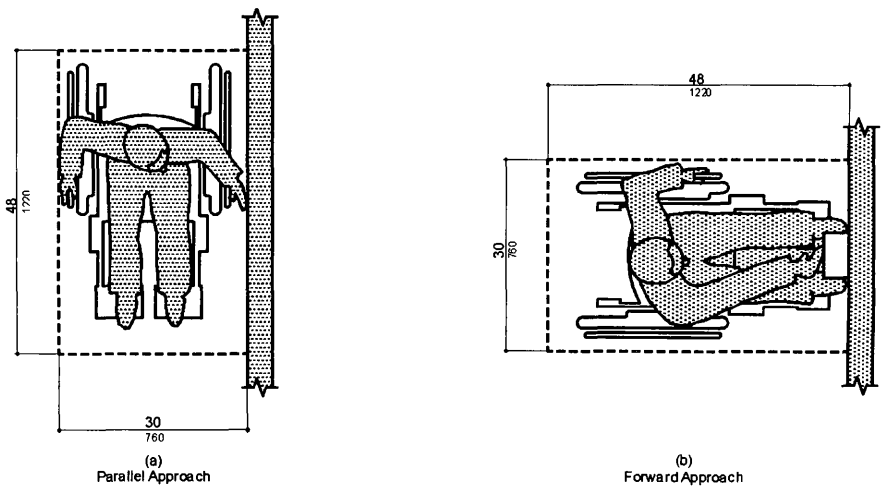
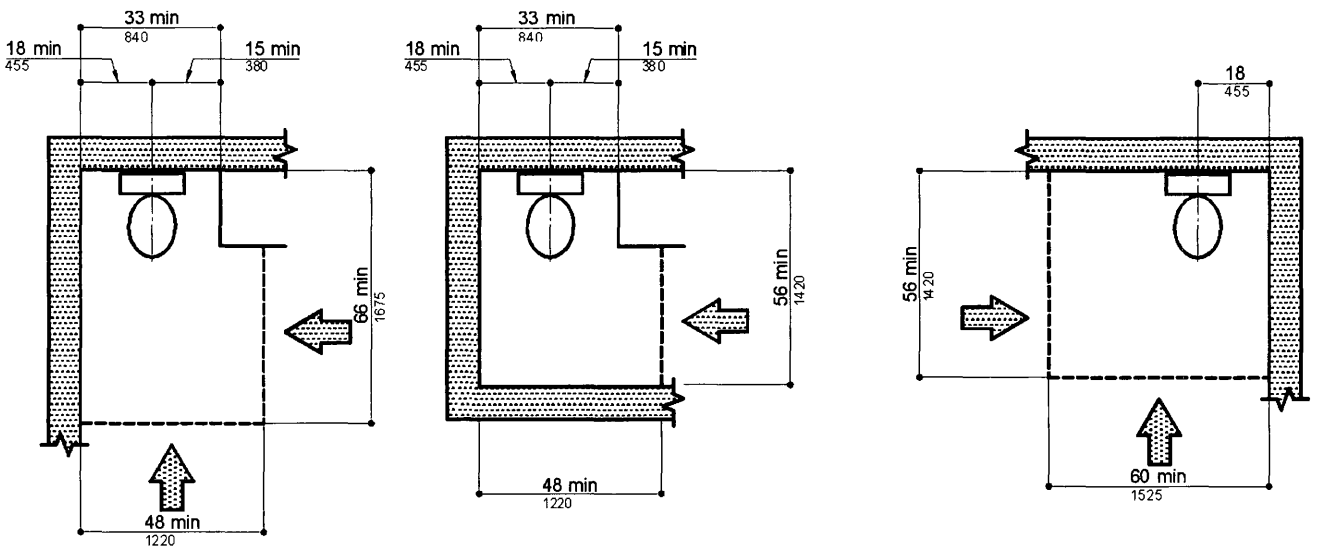
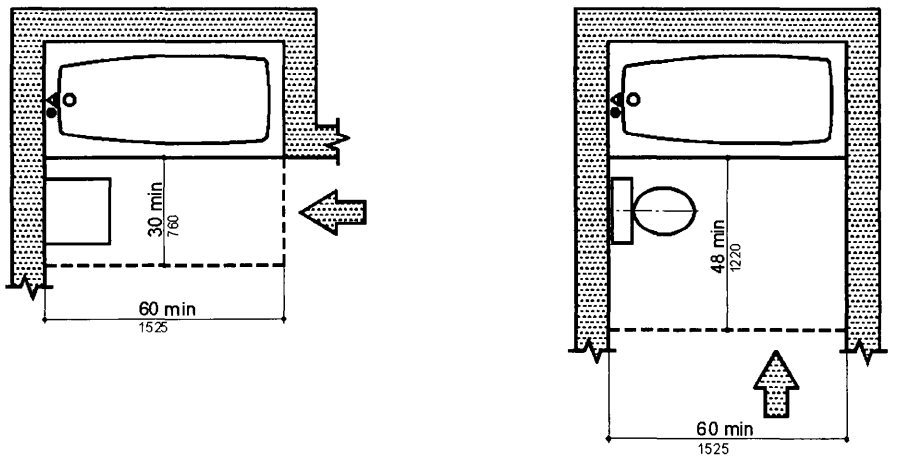


FIGURE 6
MINIMUM CLEAR FLOOR SPACE FOR WHEELCHAIRS

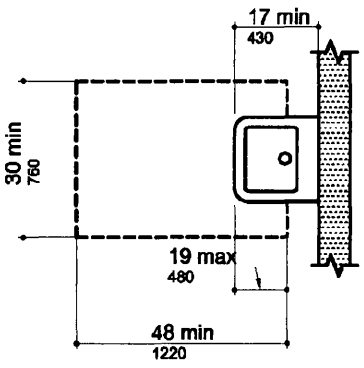


(a) Clear Floor Space at Water Closets

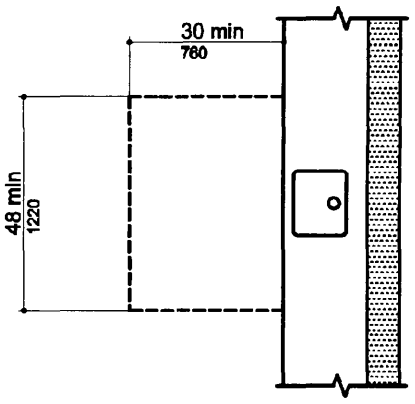


(b) Clear Floor Space at Bathtubs

FIGURE 7
CLEAR FLOOR SPACE FOR ADAPTABLE BATHROOMS

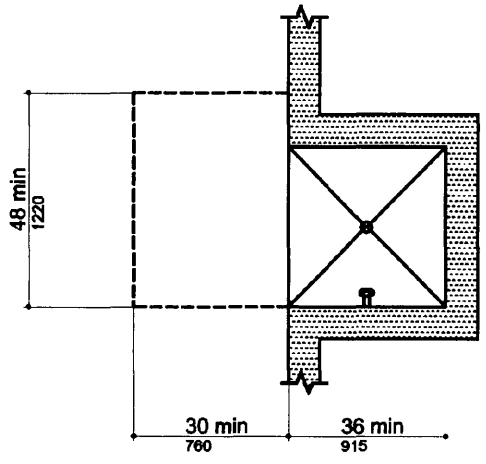


Lavatory With Knee Space



Lavatory Without Knee Space

(c) Clear Floor Space at Lavatories



(d) Clear Floor Space at Shower

FIGURE 7 (continued)
CLEAR FLOOR SPACE FOR ADAPTABLE BATHROOMS

NOTE: Clear floor space beside tub may overlap with clear floor space beneath adjacent fixtures.

Government Printing Office: 1992 - 312-222/4111

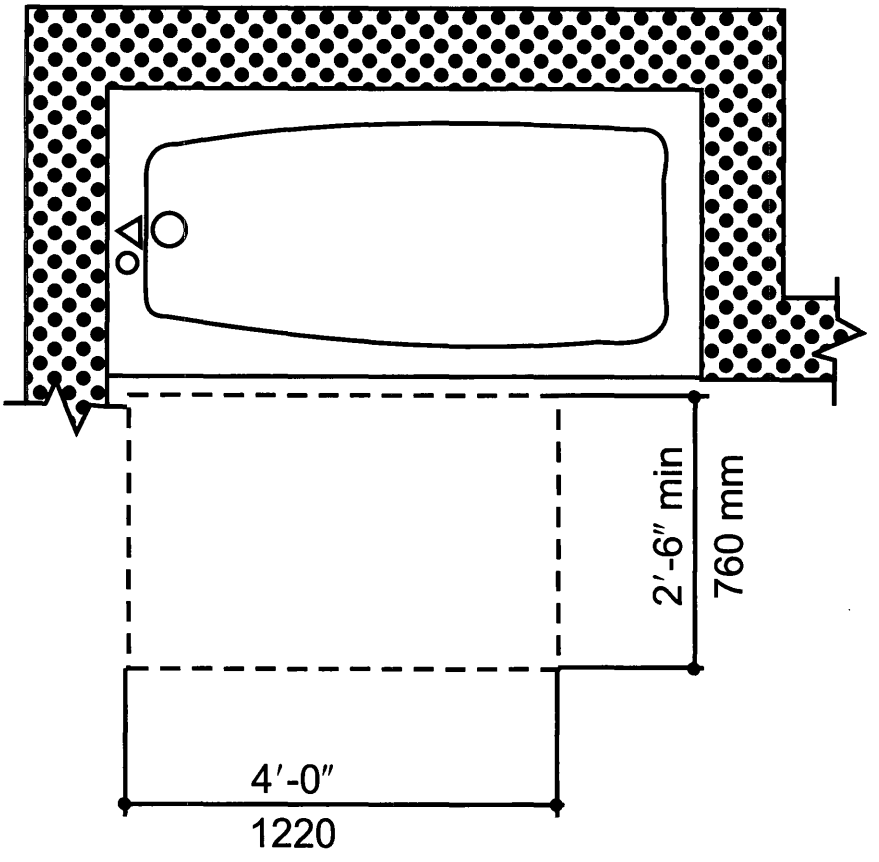


FIGURE 8
ALTERNATIVE SPECIFICATION - CLEAR FLOOR SPACE AT BATHTUB

Appendix III to Ch.I, Subchapter A —
Preamble to Final Housing Accessibility
Guidelines (Published March 6, 1991).

(FR Doc. 91-5228 Filed 3-5-91; 8:45 am)

BILLING CODE 4210-38-M

BILLING CODE 4210-24-C

CHAPTER 11
REQUEST FOR WAIVER FROM ACCESSIBILITY REQUIREMENTS CHAPTER 553, PART V, FLORIDA STATUTES
August 1999
PART C

NOTICE TO WAIVER APPLICANTS

Please make certain you comply with the following:

- The person submitting the waiver request application as the Applicant MUST sign the application. Should you fail to do so, your application will be returned.
- If a design professional (architect or engineer) has designed the project, his or her comments MUST be included as a part of this application.
- Be as explicit as possible. The more information provided to the Florida Building Commission (The Commission), the more informed its decisions can be. If you are claiming financial hardship, please specify why and to what degree.
- If at all possible, **PLAN TO ATTEND the Accessibility Advisory Council (The Council) and the Commission Meetings**. Sometimes pertinent facts are inadvertently omitted, or information provided/presented in the Request for Waiver application is not clear. Your attendance at the meetings to answer questions will enhance the possibility of the waiver being approved, since the Council and the Commission will receive the most complete information—from you. When we receive the completed application, we will send you a notice of the time, date, and place for both the Council and the Commission meetings.

Enclosed are: a **Checklist for Use by the Applicant**, a **List of Required Information**, the **Request for Waiver** application, and a copy of the administrative rule governing the Florida Building Commission procedures for reviewing requests for waivers from accessibility requirements.

If you have questions or would like additional informaiton, please call the Codes and Standards Office at (850) 487-1824.

This application is available in electronic format at:
http://www.dca.state.fl.us/fhcd/fbc/access_waiver/waiverap.htm.

Department of Community Affairs
FLORIDA BUILDING COMMISSION
2555 Shumard Oak Boulevard
Tallahassee, Florida 32399-2100

NOTICE TO WAIVER APPLICANTS

Please make certain you comply with the following:

- The person submitting the waiver request application as the Applicant MUST sign the application. Should you fail to do so, your application will be returned.
- If a licensed design professional (architect or engineer) has designed the project, his or her comments MUST be included as a part of this application.
- Be as explicit as possible. The more information provided to the Florida Building Commission, the more informed its decisions can be. If you are claiming financial hardship, please specify why and to what degree.
- If at all possible, **PLAN TO ATTEND the Accessibility Advisory Council and the Florida Building Commission meetings.** Sometimes pertinent facts are inadvertently omitted, or information provided/presented in the Request for Waiver application is not clear. Your attendance at the meetings to answer questions will enhance the possibility of the waiver being approved, since the Council and the Commission will receive the most complete information - from you. When we receive the completed application, we will send you a notice of the time, date, and place for both the Council and the Commission meetings.

Enclosed are a **List of Required Information** and the **Request for Waiver** application.

If you have questions or would like additional information, please call the Codes and Standards Section at (850)487-1824.

This application is available in electronic format at:
http://www.dca.state.fl.us/fhcd/fbc/access_waiver/waiverap.htm.

Please mail this application to the Department of Community Affairs at the address above. **As well as a hard copy, please include a copy of the application (without drawings or plans) on a 3.5 floppy disk in PC format.**

This application is available in alternate formats upon request.

LIST OF REQUIRED INFORMATION:

1. _____ Drawings that will clearly present your project and that identify the issue(s) that relate to the waiver you are requesting. As a minimum, the following drawings must be submitted:

a. Project site plan

b. 24" x 36" minimum size drawings

c. Building/project sections (if necessary to assist in understanding the waiver request)

d. Enlarged floor plan(s) of the area in question

2. _____ One set of reduced scale (11" x 17") versions of the drawings submitted in item one above.

3. _____ One set of overhead transparencies (8-1/2" x 11") of the drawings submitted in item one above. When numerous features are shown on the drawings, please designate the location of the waiver items by highlighting or outlining in color the affected areas.

4. _____ When substantial financial cost of compliance is alleged, supporting cost estimates with quotes from at least two vendors or contractors and catalog information.

5. _____ If you feel photographs and/or renderings are necessary for your presentation, provide 40 legible color photocopies of the photographs and/or renderings. If color photocopies of photographs are provided, use a minimum size of 4" x 6" photographs with a maximum of two photographs per photocopied page.

6. _____ Please submit a hard copy of this application to the Department of Community Affairs, as well as a copy of the application on a 3.5 floppy disk in PC format. PLEASE NOTE: Do not submit drawings or plans on the disk.

General Information:

a. **Equipment:** An overhead projector is provided at the presentation; any other equipment necessary for your presentation, such as TV/VCR, slide or LCD projectors, etc., is the responsibility of the applicant.

b. **Verbal Descriptions:** Presentations may be to sight or hearing impaired persons; visual presentations should consider adequate verbal and text descriptions of charts and pictures.

Your application will be reviewed by the Accessibility Advisory Council. You will have the opportunity to answer questions and/or make a short presentation **not to exceed 15 minutes.** The Council will provide recommendations to the Florida Building Commission. The Commission will review the application. You will have another opportunity to answer questions and/or give a short presentation **not to exceed 15 minutes.** The Commission will consider all information and the Council's recommendation before voting on the waiver.

This application is available in alternate formats upon request.

REQUEST FOR WAIVER FROM ACCESSIBILITY REQUIREMENTS CHAPTER 553, PART V, FLORIDA STATUTES

Your application will be reviewed by the Accessibility Advisory Council and its recommendations will be presented to the Commission. You will have the opportunity to answer questions and/or make a short presentation, not to exceed 15 minutes, at each meeting. The Commission will consider all information presented and the Council's recommendation before voting on the waiver request.

1. Name and address of project for which the waiver is requested.

Name: _____

Address: _____

_____

2. Name of Applicant. If other than the owner, please indicate relationship of applicant to owner and written authorization by owner in space provided:

Applicant's Name:
_____

Applicant's Address:
_____

Applicant's Telephone: _____ **FAX** _____

Applicant's E-mail Address:
_____

Relationship to Owner:
_____

Owner's Name _____

Owner's Address: _____

Owner's Telephone: _____ **FAX** _____

Owner's E-mail Address: _____

Signature of Owner: _____

Contact Person: _____

Contact Person's Telephone: _____ **E-mail Address:** _____

This application is available in alternate formats upon request.
Form No. 2001-01

3. Please check one of the following:

[ ] New construction.

[ ] Addition to a building or facility.

[ ] Alteration to an existing building or facility.

[ ] Historical preservation (addition).

[ ] Historical preservation (alteration).

4. Type of Facility. Please describe the building (square footage, number of floors). Define the use of the building (i.e., restaurant, office, retail, recreation, hotel/motel, etc.)

_____

_____

_____

_____

5. Project Construction Cost (Provide cost for new construction, the addition or the alteration):

_____

6. Project Status: Please check the phase of construction that best describes your project at the time of this application. Describe status.

[ ] Under Design [ ] Under Construction*

[ ] In Plan Review [ ] Completed*

* Briefly explain why the request has now been referred to the Commission.

_____

_____

_____

7. Requirements requested to be waived. Please reference the applicable section of the Florida law. Only Florida-specific accessibility requirements may be waived.

Issue

1: _____

_____

Issue

2: _____

_____

Issue

3: _____

_____

8. Reason(s) for Waiver Request: The Florida Building Commission may grant waivers of Florida-specific accessibility requirements upon a determination of unnecessary, unreasonable or extreme hardship. Please describe how this project meets the following hardship criteria. Explain all that would apply for consideration of granting the waiver.

[ ] The hardship is caused by a condition or set of conditions affecting the owner which does not affect owners in general.

_____

_____

[ ] Substantial financial costs will be incurred by the owner if the waiver is denied.

_____

_____

[ ] The owner has made a **diligent investigation** into the costs of compliance with the code, but cannot find an efficient mode of compliance. Provide detailed cost estimates and, where appropriate, photographs. Cost estimates must include bids and quotes.

_____

_____

9. Provide documented cost estimates for each portion of the waiver request and identify any additional supporting data which may affect the cost estimates. For example, for vertical accessibility, the lowest documented cost of an elevator, ramp, lift or other method of providing vertical accessibility should be provided, documented by quotations or bids from at least two vendors or contractors.

a. _____

_____

b. _____

_____

c. _____

_____

10. Licensed Design Professional: Where a design professional has designed the project, his or her comments **MUST** be included and certified by signature and affixing of his or her professional seal. The comments must include the reason(s) why the waiver is necessary.

_____

_____

_____

Signature **Printed Name**

Phone Number _____

(SEAL)

CERTIFICATION OF APPLICANT:

I hereby swear or affirm that the applicable documents in support of this Request for Waiver are attached for review by the Florida Building Commission and that all statements made in this application are to be the best of my knowledge true and correct.

Dated this _____ day of _____ , 20 _____

_____
Signature

_____
Printed Name

By signing this application, the applicant represents that the information in it is true, accurate and complete. If the applicant misrepresents or omits any material information, the Commission may revoke any order and will notify the building official of the permitting jurisdiction. Providing false information to the Commission is punishable as a misdemeanor under Section 775.083, *Florida Statutes*.

REVIEW AND RECOMMENDATION BY LOCAL BUILDING DEPARTMENT.

Please state why the issue is being referred to the Florida Building Commission as well as a recommendation for disposition. The building official or his or her designee should review the application and indicate that to the best of his or her knowledge, all information stipulated herein is true and accurate. Further, if this project is complete, explain why it is being referred to the Commission. The building official or his or her designee should sign a copy of the plans accompanying this application as certification that such plans are the same as those submitted for building department review. Please reference the applicable section of the Accessibility Code.

a. _____

b. _____

c. _____

Has there been any permitted construction activity on this building during the past three years? If so, what was the cost of construction?

[ ] Yes [ ] No Cost of Construction _____

Comments/Recommendation _____

_____

Jurisdiction _____

Building Official or Designee _____
Signature

_____
Printed Name

_____
Certification Number

_____
Telephone/FAX

Address _____

_____

Certification of Licensed Design Professional for Replicated Designs to be Placed on Consent Agenda

NOTE: This form is to be used only for cases in which design documents are duplicates of previously approved waivers and the project can be placed on a Consent Agenda pursuant to Rule 9B-7.003(3), Florida Administrative Code.

I,_____, a licensed architect/engineer in the state of Florida, whose Florida license number is _____, hereby state as follows:

1. I am the architect/engineer of record for the project known as (name of project) _____ _____, for which the Owner seeks a waiver of one or more accessibility requirements in an application to which this Certification is attached.

2. I hereby certify that to the best of my knowledge and belief to the Florida Building Commission that the design documents for the (insert project described in paragraph 1 above)_____ are the same as the design documents previously submitted to the Commission and referenced in paragraph 3 below, except that the two projects are built or to be built on different parcels of land at different locations.

3. The licensed design professional of record (identify the licensed design professional of record), _____ _____, prepared the design documents for the project known as _____ _____, for which the majority of the Accessibility Advisory Council recommended approval and the Commission granted a waiver of one or more accessibility requirements in Final Order No. _____.

Printed Name: _____ Affix certification seal below:

Address: _____

_____

Telephone: _____

Fax: _____

E-Mail Address: _____

Certification of Applicant for Replicated Designs to be Placed on Consent Agenda

NOTE: This form is to be used only for cases in which design documents are duplicates of previously approved waivers and the project can be placed on a Consent Agenda pursuant to Rule 9B-7.003(3), *Florida Administrative Code.*

I, _____, am applying for placement on the Consent Agenda pursuant to Rule 9B-7.003(3), *Florida Administrative Code*. I (check one of the following and complete blanks):

[ ] am the owner of this project (name of project) _____,

and was the owner of the project known as _____,

[ ] am the franchisee of this project (name of project)_____,

am under the same franchiser (name of franchiser) _____

who was the franchiser of the project known as_____,

[ ] am the licensee of this project (name of project) _____,

am under the same licensor (name of licensor)_____,

who was the licensor of the project known as _____,

for which the majority of the Accessibility Advisory Council recommended approval, and the Florida Building Commission granted a waiver of one or more accessibility requirements in Final Order No. _____.

I hereby swear or affirm that the above information to the best of my knowledge is true and correct.

Dated this _____ day of _____, 20 _____

_____

Signature

_____

Printed Name

Providing false information to the Florida Building Commission is punishable as a misdemeanor under Section 775.083, *Florida Statutes*.

FLORIDA ADMINISTRATIVE CODE
CHAPTER 9B-7

FLORIDA BUILDING COMMISSION — HANDICAPPED ACCESSIBILITY STANDARDS

9B-7.001 Purpose. (Repealed)

9B-7.002 Definitions. (Repealed)

9B-7.003 Procedures.

9B-7.004 Prerequisites for Consideration of Waiver Requests. (Repealed)

9B-7.0041 Guidelines for Accessible Automated Teller Machines and Fare Vending Machines (Repealed)

9B-7.0042 Florida Accessibility Code for Building Construction.

9B-7.005 Criteria for Granting of Waiver. (Repealed)

9B-7.006 Filing of Requests. (Repealed)

9B-7.003 Procedures.

(1) All applications for a waiver or modification of the requirements of the Act or the Code shall be filed on the Request for Waiver, Forms No. 2001-01 and 2001-02, which the Commission hereby incorporates by reference, effective January 20, 2002. Copies of Forms No. 2001-01 and 2001-02 are available by writing to the Codes and Standards Section, Department of Community Affairs, 2555 Shumard Oak Boulevard, Tallahassee, Florida 32399-2100. Upon certification from an applicant that all information requested by these rules has been furnished, the request will be scheduled for consideration at the Commission's next scheduled meeting provided that at least 14 days notice can be given to the members of the Advisory Council.

(2) All Requests shall be prepared in accordance with the instructions on Form 1997-03, but the Commission may waive a requirement in the instructions if the Commission finds the requirement unnecessary to the consideration of the Request. A Request shall be for one Project only, and no Request shall be considered by the Commission unless it shall have first been reviewed by the Council.

(3) The Commission and the Council may delegate to staff the authority to review an application and place it on a consent agenda only in the following circumstances:

(a) A majority of the Council has recommended approval of a waiver application accompanied by a particular set of design documents;

(b) The Commission has ordered a waiver based on the same set of design documents; and

(c) The Project for which application for a waiver is made is:

1. Owned by the same owner, franchised by the same franchiser, or licensed by the same licensor as the project previously approved by the Commission; and

2. To be built according to the same set of design documents previously approved by the Commission; and

3. The design documents described in 2. above have been certified by the architect of record using Form No. 1997-04, which the Commission hereby incorporates by reference, effective October 1, 1997. Copies of Form No. 1997-04 are available by writing to the Codes and Standards Section, Department of Community Affairs, 2555 Shumard Oak Boulevard, Tallahassee, Florida 32399-2100; and

(d) The delegation has been entered in the minutes of the meetings of the Commission and of the Council. The Commission may, upon the request of any Commission member, remove an application from the consent agenda. If an application is removed from the consent agenda, it shall be placed on the agenda for hearing in sequence that day.

(4) At its meetings, the Council shall consider all Requests, and shall prepare a recommendation for the Commission on each Request. The recommendation may be for approval, approval for a specified time, approval with a specified condition, or disapproval. If the Council finds that the Request does not give it sufficient information to make a recommendation, it may also recommend that the Commission defer action on the Request until such information is furnished. In the absence of a quorum, individual members of the Council may present recommendations to the Commission.

(5) At the meeting of the Commission, the Chairman of the Council or his designee shall present the recommendations of the Council on each Request. At its discretion, the Commission may hear any argument in support of or opposition to any Request and it may at its discretion vote upon more than one Request together. In acting upon a Request, at its discretion the Commission may wholly or partly agree or disagree with the recommendation of the Council, and may approve any Request, may approve it for a specified time, may approve it with a specified condition, may disapprove it, or may defer it for additional information.

(6) The Commission may waive one or more requirements of the Act or the Code if it finds that compliance with the literal requirements will cause an unnecessary, unreasonable, or extreme hardship. A waiver or denial of a waiver shall be applicable only to the project in the Request, and no waiver shall stand as precedent for any other project or projects. In order for the Commission to find an unnecessary, unreasonable, or extreme hardship, the owner of the project must show the following:

(a) That the hardship is caused by a condition or set of conditions affecting the owner which does not affect owners in general.

(b) That substantial financial costs will be incurred by the owner if the waiver is denied.

(c) That the owner has made a diligent investigation into the costs of compliance with the Code, but cannot find an efficient mode of compliance.

(7) The Commission shall reflect its action in a Final Order. The original of each Final Order shall be filed with the Clerk of the Department, who shall also act as Clerk of the Commission. Copies of each Final Order shall be sent by United States mail to the owner, to all professionals engaged in designing or building the project, and to the Building Official of the permitting jurisdiction. In addition, pertinent information concerning each Final Order shall be entered in a Master Topical Index of Final Orders, which shall be maintained by the Clerk of the Commission.

Specific Authority 553.512(1) FS. Law Implemented 553.512(1) FS. History–New 1-31-79, Formerly 9B-7.03, Amended 10-1-96, 9-14-97, 9-7-00, 1-20-02.

9B-7.0042 Florida Accessibility Code for Building Construction.

The 1997 Florida Accessibility Code for Building Construction (the Code) is adopted by reference as the rule of this Commission, effective October 1, 1997. The 2001 revision to the Code are herein incorporated into this rule by reference and shall take effect on the effective date of this rule. Copies of the Code and the 2001 revision are available by writing to the Codes and Standards Section, Department of Community Affairs, 2555 Shumard Oak Boulevard, Tallahassee, Florida 32399-2100.

Specific Authority 553.503 FS. Law Implemented 553.503 FS. History–New 9-14-97, Amended 10-31-99, 1-20-02.

CHAPTER 11 PART D
Section 553.501-513, Florida Statutes

ACCESSIBILITY BY HANDICAPPED PERSONS

553.501 Short title. Sections 553.501-553.513 may be cited as the "Florida Americans With Disabilities Accessibility Implementation Act."

History.—s. 1, ch. 93-183.

553.502 Intent. The purpose and intent of Sections 553.501 through 553.513 is to incorporate into the law of this state the accessibility requirements of the Americans with Disabilities Act of 1990, Pub. L. No. 101-336, 42 U.S.C. ss. 12101 et seq., and to obtain and maintain United States Department of Justice certification of the *Florida Accessibility Code for Building Construction* as equivalent to federal standards for accessibility of buildings, structures, and facilities. All state laws, rules, standards, and codes governing facilities covered by the guidelines shall be maintained to assure certification of the state's construction standards and codes. Nothing in Sections 553.501 through 553.513 is intended to expand or diminish the defenses available to a place of public accommodation under the Americans with Disabilities Act and the federal Americans with Disabilities Act Accessibility Guidelines (ADAAG), including, but not limited to, the readily achievable standard, and the standards applicable to alterations to places of public accommodation.

History.—s. 1, ch. 93-183; s. 1, ch. 97-76.

553.503 Adoption of guidelines. Subject to the exceptions in Section 553.504, the federal Americans with Disabilities Act Accessibility Guidelines, as adopted by reference in 28 C.F.R., part 36, subparts A and D, and Title II of Pub. L. No. 101-336, are hereby adopted and incorporated by reference as the law of this state. The guidelines shall establish the minimum standards for the accessibility of buildings and facilities built or altered within this state. The 1997 *Florida Accessibility Code for Building Construction* must be adopted by the Florida Building Commission in accordance with Chapter 120.

History.—s. 1, ch. 93-183; s. 2, ch. 97-76; s. 65, ch. 2000-141; s. 59, ch. 2000-154.

553.504 Exceptions to applicability of the guidelines. Notwithstanding the adoption of the ADAAG in Section 553.503, all buildings, structures, and facilities in this state shall meet the following additional requirements when they provide increased accessibility:

(1) All new or altered buildings and facilities subject to Sections 553.501 through 553.513 which may be frequented in, lived in, or worked in by the public shall comply with Section 553.501through 553.513.

(2) All new single-family houses, duplexes, triplexes, condominiums, and townhouses shall provide at least one bathroom, located with maximum possible privacy, where bathrooms are provided on habitable grade levels, with a door that has a 29-inch (737 mm) clear opening. However, if only a toilet room is provided at grade level, such toilet room shall have a clear opening of not less than 29 inches.

(3) All required doors and walk-through openings in buildings excluding single-family homes, duplexes, and triplexes not covered by the Americans with Disabilities Act of 1990 or the Fair Housing Act shall have at least 29 inches (737 mm) of clear width except under Sections 553.501 through 553.513.

(4) In addition to the requirements in reference 4.8.4 of ADAAG, all landings on ramps shall be not less than 60 inches (1524 mm) clear, and the bottom of each ramp shall have not less than 72 inches (1829 mm) of straight and level clearance.

(5) All curb ramps shall be designed and constructed in accordance with the following requirements:

(a) Notwithstanding the requirements of reference 4.8.5.2 of ADAAG, handrails on ramps which are not continuous shall extend not less than 18 inches (457 mm) beyond the sloped segment at both the top and bottom, and shall be parallel to the floor or ground surface.

(b) Notwithstanding the requirements of references 4.3.3 and 4.8.3 of ADAAG, curb ramps that are part of a required means of egress shall be not less than 44 inches (1118 mm) wide.

(c) Notwithstanding the requirements of reference 4.7.5 of ADAAG, curb ramps located where pedestrians must use them and all curb ramps which are not protected by handrails or guardrails shall have flared sides with a slope not exceeding a ratio of 1:12.

(6) Notwithstanding the requirements in reference 4.13.11 of ADAAG, exterior hinged doors shall be so designed that such doors can be pushed or pulled open with a force not exceeding 8.5 foot pounds.

(7) Notwithstanding the requirements in reference 4.33.1 of ADAAG, all public food service establishments, all establishments licensed under the Beverage Law for consumption on the premises, and all facilities governed by reference 4.1 of the guidelines shall provide seating or spaces for seating in accordance with the following requirements:

(a) For the first 100 fixed seats, accessible and usable spaces must be provided consistent with the following table:

Capacity of Seating In Assembly Areas	Number of Required Wheelchair Locations
1 to 25	1
26 to 50	2
51 to 100	4

(b) For all remaining fixed seats, there shall be not less than one such accessible and usable space for each 100 fixed seats or fraction thereof.

(8) Notwithstanding the requirements in references 4.32.1-4.32.4 of ADAAG, all fixed seating in public food service establishments, in establishments licensed under the Beverage Law for consumption on the premises, and in all other facilities governed by reference 4.1 of ADAAG shall be designed and constructed in accordance with the following requirements:

(a) All aisles adjacent to fixed seating shall provide clear space for wheelchairs.

(b) Where there are open positions along both sides of such aisles, the aisles shall be not less than 52 inches (1321 mm) wide.

(9) In motels and hotels a number of rooms equaling at least 5 percent of the guestrooms minus the number of accessible rooms required by ADAAG shall provide the following special accessibility features:

(a) Grab rails in bathrooms and toilet rooms that comply with Section 4.16.4 of ADAAG.

(b) All beds in designed accessible guest rooms shall be open-frame type to permit passage of lift devices.

(c) All standard water closet seats shall be at a height of 15 inches (381 mm), measured vertically from the finished floor to the top of the seat, with a variation of plus or minus $^1/_2$ inch (12.7 mm). A portable or attached raised toilet seat shall be provided in all designated handicapped accessible rooms.

All buildings, structures, or facilities licensed as a hotel, motel, or condominium pursuant to Chapter 509 shall be subject to the provisions of this subsection. Nothing in this subsection shall be construed as relieving the owner of the responsibility of providing accessible rooms in conformance with Sections 9.1 through 9.5 of ADAAG.

(10) Notwithstanding the requirements in reference 4.29.2 of the guidelines, all detectable warning surfaces required by the guidelines shall be governed by the requirements of ANSI A117.1-1986.

(11) Notwithstanding the requirements in references 4.31.2 and 4.31.3 of the guidelines, the installation and placement of all public telephones shall be governed by the rules of the Florida Public Service Commission.

(12) Notwithstanding the requirements in references 4.1.3(11) and 4.16-4.23 of ADAAG, required restrooms and toilet rooms in new construction shall be designed and constructed in accordance with the following requirements:

(a) The standard accessible restroom stall shall contain an accessible lavatory within it, the size of such lavatory to be not less than 19 inches wide by 17 inches (483 mm by 432 mm) deep, nominal size, and wall-mounted. The lavatory shall be mounted so as not to overlap the clear floor space areas required by Section 4.17, Figure 30(a) of ADAAG for the standard accessible stall and to comply with Section 4.19 of ADAAG. Such lavatories shall be counted as part of the required fixture count for the building.

(b) The accessible water closet shall be located in the corner, diagonal to the door.

(c) The accessible stall door shall be self-closing.

(13) All customer checkout aisles not required by the guidelines to be handicapped accessible shall have at least 32 inches (813 mm) of clear passage.

(14) Turnstiles shall not be used in occupancies which serve fewer than 100 persons, but turnstiles may be used in occupancies which serve at least 100 persons if there is an unlocked alternate passageway on an accessible route affording not less than 32 inches (813 mm) of clearance, equipped with latching devices in accordance with the guidelines.

(15) Barriers at common or emergency entrances and exits of business establishments conducting business with the general public that are existing, under construction, or under contract for construction which would prevent a person from using such entrances or exits shall be removed.

History.—s. 1, ch. 93-183; s. 3, ch. 97-76.

553.5041 Parking spaces for persons who have disabilities.

(1) This section is not intended to expand or diminish the defenses available to a place of public accommodation under the Americans with Disabilities Act and the federal ADAAG, including, but not limited to, the readily achievable standard, and the standards applicable to alterations to places of public accommodation. Subject to the exceptions described in subsections (2), (4), (5), and (6), when the parking and loading zone requirements of the federal ADAAG, as

adopted by reference in 28 C.F.R. part 36, subparts A and D, and Title II of Pub. L. No. 101-336, provide increased accessibility, those requirements are adopted and incorporated by reference as the law of this state.

(2) State agencies and political subdivisions having jurisdiction over street parking or publicly owned or operated parking facilities are not required to provide a greater right-of-way width than would otherwise be planned under regulations, guidelines, or practices normally applied to new development.

(3) If parking spaces are provided for self-parking by employees or visitors, or both, accessible spaces shall be provided in each such parking area. Such spaces shall be designed and marked for the exclusive use of those individuals who have a severe physical disability and have permanent or temporary mobility problems that substantially impair their ability to ambulate and who have been issued either a disabled parking permit under Section 316.1958 or 320.0848 or a license plate under Section 320.084, 320.0842, 320.0843 or 320.0845.

(4) The number of accessible parking spaces must comply with the parking requirements in ADAAG Section 4.1 and the following:

(a) There must be one accessible parking space in the immediate vicinity of a publicly owned or leased building that houses a governmental entity or a political subdivision, including, but not limited to, state office buildings and courthouses, if no parking for the public is provided on the premises of the building.

(b) There must be one accessible parking space for each 150 metered on-street parking spaces provided by state agencies and political subdivisions.

(c) The number of parking spaces for persons who have disabilities must be increased on the basis of demonstrated and documented need.

(5) Accessible perpendicular and diagonal accessible parking spaces and loading zones must be designed and located in conformance with the guidelines set forth in ADAAG ss. 4.1.2 and 4.6 and Appendix A4.6.,3 "Universal Parking Design."

(a) All spaces must be located on an accessible route no less than 44 inches (1118 mm) wide so that users will not be compelled to walk or wheel behind parked vehicles.

(b) Each space must be located on the shortest safely accessible route from the parking space to an accessible entrance. If there are multiple entrances or multiple retail stores, the parking spaces must be dispersed to provide parking at the nearest accessible entrance. If a theme park or an entertainment complex as defined in Section 509.013(9) provides parking in several lots or areas from which access to the theme park or entertainment complex is provided, a single lot or area may be designated for parking by persons who have disabilities, if the lot or area is located on the shortest safely accessible route to an accessible entrance to the theme park or entertainment complex or to transportation to such an accessible entrance.

(c)

1. Each parking space must be no less than 12 feet (3658 mm) wide. Parking access aisles must be no less than 5 feet (1524 mm) wide and must be part of an accessible route to the building or facility entrance. In accordance with ADAAG Section 4.6.3, access aisles must be placed adjacent to accessible parking spaces; however, two accessible parking spaces may share a common access aisle. The access aisle must be striped diagonally to designate it as a no-parking zone.

2. The parking access aisles are reserved for the temporary exclusive use of persons who have disabled parking permits and who require extra space to deploy a mobility device, lift, or ramp in order to exit from or enter a vehicle. Parking is not allowed in an access aisle. Violators are subject to the same penalties that are imposed for illegally parking in parking spaces that are designated for persons who have disabilities. A vehicle may not be parked in an access aisle, even if the vehicle owner or passenger is disabled or owns a disabled parking permit.

3. Any provision of this subsection to the contrary notwithstanding, a theme park or an entertainment complex as defined in Section 509.013(9) in which are provided continuous attendant services for directing individuals to marked accessible parking spaces or designated lots for parking by persons who have disabilities, may, in lieu of the required parking space design, provide parking spaces that comply with ADAAG Sections 4.1 and 4.6.

(d) On-street parallel parking spaces must be located either at the beginning or end of a block or adjacent to alley entrances. Such spaces must be designed in conformance with the guidelines set forth in ADAAG Sections 4.6.2 through 4.6.5.

Exception: Access aisles are not required.

Curbs adjacent to such spaces must be of a height that will not interfere with the opening and closing of motor vehicle doors. This subsection does not relieve the owner of the responsibility to comply with the parking requirements of ADAAG Sections 4.1 and 4.6.

(e) Parallel parking spaces must be even with surface slopes, may match the grade of the adjacent travel lane, and must not exceed a cross slope of 1:50, where feasible.

(f) Curb ramps must be located outside of the disabled parking spaces and access aisles.

(g)

1. The removal of architectural barriers from a parking facility in accordance with 28 C.F.R. Section 36.304 or with Section 553.508 must comply with this section unless compliance would cause the barrier removal not to be readily achievable. If compliance would cause the barrier removal not to be readily

achievable, a facility may provide parking spaces at alternative locations for persons who have disabilities and provide appropriate signage directing persons who have disabilities to the alternative parking if readily achievable. The facility may not reduce the required number or dimensions of those spaces, nor may it unreasonably increase the length of the accessible route from a parking space to the facility. The removal of an architectural barrier must not create a significant risk to the health or safety of a person who has a disability or to that of others.

2. A facility that is making alterations under Section 553.507(2)(b) must comply with this section to the maximum extent feasible. If compliance with parking location requirements is not feasible, the facility may provide parking spaces at alternative locations for persons who have disabilities and provide appropriate signage directing persons who have a disability to alternative parking. The facility may not reduce the required number or dimensions of those spaces, nor may it unnecessarily increase the length of the accessible route from a parking space to the facility. The alteration must not create a significant risk to the health or safety of a person who has a disability or to that of others.

(6) Each such parking space must be prominently outlined with blue paint, and must be repainted when necessary, to be clearly distinguishable as a parking space designated for persons who have disabilities and must be posted with a permanent above-grade sign of a color and design approved by the Department of Transportation, which is placed on or at a distance of 84 inches (2134 mm) above the ground to the bottom of the sign and which bears the international symbol of accessibility meeting the requirements of ADAAG Section 4.30.7 and the caption "PARKING BY DISABLED PERMIT ONLY." Such a sign erected after October 1, 1996, must indicate the penalty for illegal use of the space. Any provision of this section to the contrary notwithstanding, in a theme park or an entertainment complex as defined in Section 509.013(9) in which accessible parking is located in designated lots or areas, the signage indicating the lot as reserved for accessible parking may be located at the entrances to the lot in lieu of a sign at each parking place. This subsection does not relieve the owner of the responsibility of complying with the signage requirements of ADAAG Section 4.30.

History.—s. 66, ch. 2000-141.

553.505 Exceptions to applicability of the Americans with Disabilities Act. Notwithstanding the Americans with Disabilities Act of 1990, private clubs are governed by Sections 553.501 through 553.513. Parking spaces, parking lots, and other parking facilities are governed by Section 553.5041 when that section provides increased accessibility.

History.—s. 1, ch. 93-183; s. 14, ch. 96-200; s. 4, ch. 97-76; s. 23, ch. 2001-186.

553.506 Powers of the commission. In addition to any other authority vested in the Florida Building Commission by law, the commission, in implementing Sections 553.501 through 553.513, may, by rule, adopt revised and updated versions of the ADAAG in accordance with Chapter 120.

History.—s. 1, ch. 93-183; s. 67, ch. 2000-141; s. 60, ch. 2000-154.

553.507 Exemptions. Sections 553.501 through 553.513 do not apply to any of the following:

(1) Buildings, structures, or facilities that were either under construction or under contract for construction on October 1, 1997.

(2) Buildings, structures, or facilities that were in existence on October 1, 1997, unless:

(a) The building, structure, or facility is being converted from residential to nonresidential or mixed use, as defined by local law;

(b) The proposed alteration or renovation of the building, structure, or facility will affect usability or accessibility to a degree that invokes the requirements of Section 303(a) of the Americans with Disabilities Act of 1990; or

(c) The original construction or any former alteration or renovation of the building, structure, or facility was carried out in violation of applicable permitting law.

History.—s. 1, ch. 93-183; s. 5, ch. 97-76; s. 31, ch. 2001-63; s. 24, ch. 2001-186.

553.508 Architectural barrier removal. Removal of architectural barriers, pursuant to 28 C.F.R. Section 36.304, from buildings, structures, or facilities to which this act applies shall comply with Sections 553.501 through 553.513 unless compliance would render the removal not readily achievable. In no instance shall the removal of an architectural barrier create a significant risk to the health or safety of an individual with a disability or others.

History.—s. 1, ch. 93-183.

553.509 Vertical accessibility. Nothing in Sections 553.501 through 553.513 or the guidelines shall be construed to relieve the owner of any building, structure, or facility governed by those sections from the duty to provide vertical accessibility to all levels above and below the occupiable grade level, regardless of whether the guidelines require an elevator to be installed in such building, structure, or facility, except for:

(1) Elevator pits, elevator penthouses, mechanical rooms, piping or equipment catwalks, and automobile lubrication and maintenance pits and platforms;

(2) Unoccupiable spaces, such as rooms, enclosed spaces, and storage spaces that are not designed for human occupancy, for public accommodations, or for work areas; and

(3) Occupiable spaces and rooms that are not open to the public and that house no more than five persons, including, but not limited to, equipment control rooms and projection booths.

However, buildings, structures, and facilities must, as a minimum, comply with the requirements in the ADAAG.

History.—s. 1, ch. 93-183; s. 6, ch. 97-76.

553.511 Parking facilities; minimum height clearance requirement. Every nonresidential structure built on or after January 1, 1991, which is designed to use covered or underground parking as the primary available parking space shall design the covered or underground parking facility to maintain a minimum height for the portion of the street-accessible level of the parking facility directly over van-accessible parking spaces and for providing ingress and egress to such parking spaces of at least 8 feet 2 inches (2489 mm). Signs shall be posted to warn operators of handicap-equipped vans that they cannot pass beyond a certain point due to height limitations. If compliance with this minimum height clearance requirement will cause the structure to exceed local height limitations imposed by local zoning, planning, or fire ordinances, or will result in the imposition of any additional requirements of such ordinances, the structure may exceed the height limitation specified in those particular codes as necessary to comply with the requirements of this section and is exempt from such additional requirements. Structures for which the plans were sealed by an architect prior to January 1, 1991, are exempt from this section.

History.—s. 2, ch. 90-250; s. 2, ch. 93-183; s. 7, ch. 97-76.

Note.—Former s. 553.482.

553.512 Modifications and waivers; advisory council.

(1) The Florida Building Commission shall provide by regulation criteria for granting individual modifications of, or exceptions from, the literal requirements of this part upon a determination of unnecessary, unreasonable, or extreme hardship, provided such waivers shall not violate federal accessibility laws and regulations and shall be reviewed by the Accessibility Advisory Council. Notwithstanding any other provision of this subsection, if an applicant for a waiver demonstrates economic hardship in accordance with 28 C.F.R. Section 36.403(f)(1), a waiver shall be granted. The commission may not consider waiving any of the requirements of s. 553.5041 unless the applicant first demonstrates that she or he has applied for and been denied waiver or variance from all local government zoning, subdivision regulations, or other ordinances that prevent compliance therewith. Further, the commission may not waive the requirement of Section 553.5041(5)(a) and (c)1. governing the minimum width of accessible routes and minimum width of accessible parking spaces.

(2) The Accessibility Advisory Council shall consist of the following seven members, who shall be knowledgeable in the area of accessibility for persons with disabilities. The Secretary of Community Affairs shall appoint the following: a representative from the Advocacy Center for Persons with Disabilities, Inc.; a representative from the Division of Blind Services; a representative from the Division of Vocational Rehabilitation; a representative from a statewide organization representing the physically handicapped; a representative from the hearing impaired; a representative from the President, Florida Council of Handicapped Organizations; and a representative of the Paralyzed Veterans of America. The terms for the first three council members appointed subsequent to October 1, 1991, shall be for 4 years, the terms for the next two council members appointed shall be for three years, and the terms for the next two members shall be for two years. Thereafter, all council member appointments shall be for terms of four years. No council member shall serve more than two four-year terms subsequent to October 1, 1991. Any member of the council may be replaced by the secretary upon three unexcused absences. Upon application made in the form provided, an individual waiver or modification may be granted by the commission so long as such modification or waiver is not in conflict with more stringent standards provided in another chapter.

(3) Members of the council shall serve without compensation, but shall be entitled to reimbursement for per diem and travel expenses as provided by Section 112.061.

(4) Meetings of the advisory council shall be held in conjunction with the regular meetings of the commission.

History.—s. 3, ch. 78-333; s. 1, ch. 82-46; s. 2, ch. 83-265; s. 25, ch. 86-220; s. 5, ch. 89-97; ss. 1, 5, 6, ch. 91-172; s. 5, ch. 91-429; s. 2, ch. 93-183; s. 10, ch. 97-76; s. 68, ch. 2000-141; s. 61, ch. 2000-154; s. 13, ch. 2002-293.

Note.—Former s. 553.49.

553.513 Enforcement. It shall be the responsibility of each local government and each code enforcement agency established pursuant to Section 553.80 to enforce the provisions of this part. This act expressly preempts the establishment of handicapped accessibility standards to the state and supersedes any county or municipal ordinance on the subject. However, nothing in this section shall prohibit municipalities and counties from enforcing the provisions of this act.

History.—s. 6, ch. 89-97; s. 2, ch. 93-183.

Note.—Former s. 553.495.

CHAPTER 12
INTERIOR ENVIRONMENT

SECTION 1201
GENERAL

1201.1 Scope. The provisions of this chapter shall govern ventilation, temperature control, lighting, yards and courts, sound transmission, room dimensions, surrounding materials and rodent proofing associated with the interior spaces of buildings.

SECTION 1202
DEFINITIONS

1202.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

SUNROOM

1. A room with roof panels that include sloped glazing that is a one-story structure added to an existing dwelling with an open or glazed area in excess of 40 percent of the gross area of the sunroom structure's exterior walls and roof.
2. A one-story structure added to a dwelling with structural roof panels without sloped glazing. The sunroom walls may have any configuration, provided the open area of the longer wall and one additional wall is equal to at least 65 percent of the area below 6 feet 8 inches of each wall, measured from the floor.

   For the purposes of this code the term sunroom as used herein shall include conservatories, sunspaces, solariums, and porch or patio covers or enclosures.

SUNROOM ADDITION. A one-story addition added to an existing building with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

THERMAL ISOLATION. A separation of conditioned spaces, between a sunroom addition and a dwelling unit, consisting of existing or new wall(s), doors and/or windows.

SECTION 1203
VENTILATION

1203.1 General. Buildings shall be provided with natural ventilation in accordance with Section 1203.4, or mechanical ventilation in accordance with the *Florida Building Code, Mechanical.*

1203.2 Attic spaces. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. A minimum of 1 inch (25 mm) of airspace shall be provided between the insulation and the roof sheathing. The net free ventilating area shall not be less than $^1/_{150}$ of the area of the space ventilated, with 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents.

Exceptions:

1. The minimum required net free ventilating area shall be $^1/_{300}$ of the area of the space ventilated, provided a vapor retarder having a transmission rate not exceeding 1 perm in accordance with ASTM E 96 is installed on the warm side of the attic insulation and provided 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents, with the balance of the required ventilation provided by eave or cornice vents.
2. Attic spaces, designed by a Florida-licensed engineer or registered architect to eliminate the attic venting.

1203.2.1 Openings into attic. Exterior openings into the attic space of any building intended for human occupancy shall be covered with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material that will prevent the entry of birds, squirrels, rodents, snakes and other similar creatures. The openings therein shall be a minimum of $^1/_8$ inch (3.2 mm) and shall not exceed $^1/_4$ inch (6.4 mm). Where combustion air is obtained from an attic area, it shall be in accordance with Chapter 7 of the *Florida Building Code, Mechanical.*

1203.3 Under-floor ventilation. The space between the bottom of the floor joists and the earth under any building except spaces occupied by a basement or cellar shall be provided with ventilation openings through foundation walls or exterior walls. Such openings shall be placed so as to provide cross ventilation of the under-floor space.

1203.3.1 Openings for under-floor ventilation. The minimum net area of ventilation openings shall not be less than 1 square foot for each 150 square feet (0.67 m^2 for each 100 m^2) of crawl-space area. Ventilation openings shall be covered for their height and width with any of the following materials, provided that the least dimension of the covering shall not exceed $^1/_4$ inch (6 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grilles or gratings.
4. Extruded load-bearing vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.

6. Corrosion-resistant wire mesh, with the least dimension not exceeding $^1/_8$ inch (3.2 mm).

1203.3.2 Exceptions. The following are exceptions to Sections 1203.3 and 1203.3.1:

1. Where warranted by climatic conditions, ventilation openings to the outdoors are not required if ventilation openings to the interior are provided.
2. The total area of ventilation openings is permitted to be reduced to $^1/_{1,500}$ of the under-floor area where the ground surface is treated with an approved vapor retarder material and the required openings are placed so as to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited.
3. Ventilation openings are not required where continuously operated mechanical ventilation is provided at a rate of 1.0 cubic foot per minute (cfm) for each 50 square feet (1.02 L/s for each 10 m^2) of crawl-space floor area and the ground surface is covered with an approved vapor retarder.
4. Ventilation openings are not required when the ground surface is covered with an approved vapor retarder, the perimeter walls are insulated and the space is conditioned in accordance with Chapter 13 of *Florida Building Code, Building*.
5. Crawl spaces, designed by a Florida-licensed engineer or registered architect to eliminate the venting.

1203.4 Natural ventilation. Natural ventilation of an occupied space shall be through windows, doors, louvers or other openings to the outdoors. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants.

1203.4.1 Ventilation area required. The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

1203.4.1.1 Adjoining spaces. Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining room shall be unobstructed and shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.3 m^2). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

Exception: Exterior openings required for ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover provided that the openable area between the sunroom addition or patio cover and the interior room shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 20 square feet (1.86 m^2). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

1203.4.1.2 Openings below grade. Where openings below grade provide required natural ventilation, the outside horizontal clear space measured perpendicular to the opening shall be one and one-half times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

1203.4.2 Contaminants exhausted. Contaminant sources in naturally ventilated spaces shall be removed in accordance with the *Florida Building Code, Mechanical* and the *Florida Fire Prevention Code*.

1203.4.2.1 Bathrooms. Rooms containing bathtubs, showers, spas and similar bathing fixtures shall be mechanically ventilated in accordance with the *Florida Building Code, Mechanical*.

1203.4.3 Openings on yards or courts. Where natural ventilation is to be provided by openings onto yards or courts, such yards or courts shall comply with Section 1206.

1203.5 Other ventilation and exhaust systems. Ventilation and exhaust systems for occupancies and operations involving flammable or combustible hazards or other contaminant sources as covered in the *Florida Building Code, Mechanical* or the *Florida Fire Prevention Code* shall be provided as required by both codes.

SECTION 1204
TEMPERATURE CONTROL

1204.1 Equipment and systems. Interior spaces intended for human occupancy shall be provided with active or passive space-heating systems capable of maintaining a minimum indoor temperature of 68°F (20°C) at a point 3 feet (914 mm) above the floor on the design heating day.

Exception: Interior spaces where the primary purpose is not associated with human comfort.

SECTION 1205
LIGHTING

1205.1 General. Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings in accordance with Section 1205.2 or shall be provided with artificial light in accordance with Section 1205.3. Exterior glazed openings shall open directly onto a public way or onto a yard or court in accordance with Section 1206.

1205.2 Natural light. The minimum net glazed area shall not be less than 8 percent of the floor area of the room served.

1205.2.1 Adjoining spaces. For the purpose of natural lighting, any room is permitted to be considered as a portion of an adjoining room where one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or 25 square feet (2.32 m^2), whichever is greater.

Exception: Openings required for natural light shall be permitted to open into a thermally isolated sunroom addition or patio cover where the common wall provides a glazed area of not less than one-tenth of the floor area of the interior room or 20 square feet (1.86 m^2), whichever is greater.

1205.2.2 Exterior openings. Exterior openings required by Section 1205.2 for natural light shall open directly onto a public way, yard or court, as set forth in Section 1206.

Exceptions:

1. Required exterior openings are permitted to open into a roofed porch where the porch:
   1.1. Abuts a public way, yard or court.
   1.2. Has a ceiling height of not less than 7 feet (2134 mm).
   1.3. Has a longer side at least 65 percent open and unobstructed.
2. Skylights are not required to open directly onto a public way, yard or court.

1205.3 Artificial light. Artificial light shall be provided that is adequate to provide an average illumination of 10 foot-candles (107 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

1205.4 Stairway illumination. Stairways within dwelling units and exterior stairways serving a dwelling unit shall have an illumination level on tread runs of not less than 1 foot-candle (11 lux). Stairs in other occupancies shall be governed by Chapter 10.

1205.4.1 Controls. The control for activation of the required stairway lighting shall be in accordance with Chapter 27 of the *Florida Building Code, Building*.

1205.5 Emergency egress lighting. The means of egress shall be illuminated in accordance with Section 1006.1.

SECTION 1206
YARDS OR COURTS

1206.1 General. This section shall apply to yards and courts adjacent to exterior openings that provide natural light or ventilation. Such yards and courts shall be on the same property as the building.

1206.2 Yards. Yards shall not be less than 3 feet (914 mm) in width for one- and two-story buildings. For buildings more than two stories in height, the minimum width of the yard shall be increased at the rate of 1 foot (305 mm) for each additional story. For buildings exceeding 14 stories in height, the required width of the yard shall be computed on the basis of 14 stories.

1206.3 Courts. Courts shall not be less than 3 feet (914 mm) in width. Courts having windows opening on opposite sides shall not be less than 6 feet (1829 mm) in width. Courts shall not be less than 10 feet (3048 mm) in length unless bounded on one end by a public way or yard. For buildings more than two stories in height, the court shall be increased 1 foot (305 mm) in width and 2 feet (310 mm) in length for each additional story. For buildings exceeding 14 stories in height, the required dimensions shall be computed on the basis of 14 stories.

1206.3.1 Court access. Access shall be provided to the bottom of courts for cleaning purposes.

1206.3.2 Air intake. Courts more than two stories in height shall be provided with a horizontal air intake at the bottom not less than 10 square feet (0.93 m^2) in area and leading to the exterior of the building unless abutting a yard or public way.

1206.3.3 Court drainage. The bottom of every court shall be properly graded and drained to a public sewer or other approved disposal system complying with the *Florida Building Code, Plumbing*.

SECTION 1207
SOUND TRANSMISSION

1207.1 Scope. This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units or between dwelling units and adjacent public areas such as halls, corridors, stairs or service areas.

1207.2 Air-borne sound. Walls, partitions and floor/ceiling assemblies separating dwelling units from each other or from public or service areas shall have a sound transmission class (STC) of not less than 50 (45 if field tested) for air-borne noise when tested in accordance with ASTM E 90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. This requirement shall not apply to dwelling unit entrance doors; however, such doors shall be tight fitting to the frame and sill.

1207.3 Structure-borne sound. Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within the structure shall have an impact insulation class (IIC) rating of not less than 50 (45 if field tested) when tested in accordance with ASTM E 492.

SECTION 1208
INTERIOR SPACE DIMENSIONS

1208.1 Minimum room widths. Habitable spaces, other than a kitchen, shall not be less than 7 feet (2134 mm) in any plan dimension. Kitchens shall have a clear passageway of not less than 3 feet (914 mm) between counter fronts and appliances or counter fronts and walls.

1208.2 Minimum ceiling heights. Occupiable spaces, habitable spaces and corridors shall have a ceiling height of not less than 7 feet 6 inches (2286 mm). Bathrooms, toilet rooms, kitchens, storage rooms and laundry rooms shall be permitted to have a ceiling height of not less than 7 feet (2134 mm).

Exceptions:

1. In one- and two-family dwellings, beams or girders spaced not less than 4 feet (1219 mm) on center and projecting not more than 6 inches (152 mm) below the required ceiling height.
2. If any room in a building has a sloped ceiling, the prescribed ceiling height for the room is required in one-half the area thereof. Any portion of the room measuring less than 5 feet (1524 mm) from the finished floor to the ceiling shall not be included in any computation of the minimum area thereof. For accessibility provisions related to vertical clearance of

areas adjoining an accessible route, refer to Section 11-4.4.2.

3. Mezzanines constructed in accordance with Section 505.1.

1208.2.1 Furred ceiling. Any room with a furred ceiling shall be required to have the minimum ceiling height in two-thirds of the area thereof, but in no case shall the height of the furred ceiling be less than 7 feet (2134 mm).

1208.3 Room area. Every dwelling unit shall have at least one room that shall have not less than 120 square feet (13.9 m^2) of net floor area. Other habitable rooms shall have a net floor area of not less than 70 square feet (6.5 m^2).

Exception: Every kitchen in a one- and two-family dwelling shall have not less than 50 square feet (4.64 m^2) of gross floor area.

1208.4 Efficiency dwelling units. An efficiency living unit shall conform to the requirements of the code except as modified herein:

1. The unit shall have a living room of not less than 220 square feet (20.4 m^2) of floor area. An additional 100 square feet (9.3 m^2) of floor area shall be provided for each occupant of such unit in excess of two.
2. The unit shall be provided with a separate closet.
3. The unit shall be provided with a kitchen sink, cooking appliance and refrigeration facilities, each having a clear working space of not less than 30 inches (762 mm) in front. Light and ventilation conforming to this code shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower.

SECTION 1209
ACCESS TO UNOCCUPIED SPACES

1209.1 Crawl spaces. Crawl spaces shall be provided with a minimum of one access opening not less than 18 inches by 24 inches (457 mm by 610 mm).

1209.2 Attic spaces. An opening not less than 20 inches by 30 inches (559 mm by 762 mm) shall be provided to any attic area having a clear height of over 30 inches (762 mm). A 30-inch (762 mm) minimum clear headroom in the attic space shall be provided at or above the access opening.

1209.3 Mechanical appliances. Access to mechanical appliances installed in under-floor areas, in attic spaces and on roofs or elevated structures shall be in accordance with the *Florida Building Code, Mechanical*.

SECTION 1210
SURROUNDING MATERIALS

1210.1 Floors. In other than dwelling units, toilet and bathing room floors shall have a smooth, hard, nonabsorbent surface that extends upward onto the walls at least 6 inches (152 mm).

1210.2 Walls. Walls within 2 feet (610 mm) of urinals and water closets shall have a smooth, hard, nonabsorbent surface, to a height of 4 feet (1219 mm) above the floor, and except for structural elements, the materials used in such walls shall be of a type that is not adversely affected by moisture.

Exceptions:

1. Dwelling units and sleeping units.
2. Toilet rooms that are not accessible to the public and which have not more than one water closet.

Accessories such as grab bars, towel bars, paper dispensers and soap dishes, provided on or within walls, shall be installed and sealed to protect structural elements from moisture.

1210.3 Showers. Shower compartments and walls above bathtubs with installed shower heads shall be finished with a smooth, nonabsorbent surface to a height not less than 70 inches (1778 mm) above the drain inlet.

1210.4 Waterproof joints. Built-in tubs with showers shall have waterproof joints between the tub and adjacent wall.

1210.5 Toilet rooms. Toilet rooms shall not open directly into a room used for the preparation of food for service to the public.

CHAPTER 13

ENERGY EFFICIENCY

SUBCHAPTER 13-1
ADMINISTRATION AND ENFORCEMENT

SECTION 13-100
GENERAL

13-100.1 Title. This chapter shall be known as the *Florida Energy Efficiency Code for Building Construction*, and may be cited as such. It will be referred to herein as "the code" or "this code."

13-100.2 Intent. The provisions of this code shall regulate (1) the design of building envelopes for adequate thermal resistance and low air leakage and (2) the design and selection of mechanical, electrical, and illumination systems and equipment which will enable the effective use of energy in new building construction, additions, alterations or any change in building configuration.

It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. These provisions are structured to permit compliance with the intent of this code by the following design paths as applicable for the type of construction and date permitted.

1. Subchapter 13-4, Commercial Building Compliance Methods.
2. Subchapter 13-6, Residential Building Compliance Methods.

Compliance with these paths meets the intent of this chapter as allowed by Sections 101.1 and 101.2 of this chapter.

This code is not intended to abridge any safety or health requirements mandated under any other applicable codes or ordinances.

SECTION 13-101
SCOPE

13-101.0 General. This code is a statewide uniform code and shall not be made more stringent or lenient by local government. The code provides for a uniform standard of energy efficiency by, at a minimum, setting forth minimum requirements for exterior envelopes, lighting, electrical distribution, and selection of heating, lighting, ventilating, air conditioning and service water heating systems. It shall apply to all new buildings, to additions to existing buildings and manufactured homes, to renovations to existing buildings, both public and private, with certain exceptions, to changes of occupancy type, to the site-installed components and features of manufactured homes at their first set-up, and to the installation or replacement of building systems and components with new products for which thermal efficiency standards are set by this code. New buildings, with the exception of those exempted below, and in accordance with the specific exceptions of individual sections shall be designed to comply with Subchapter 13-4 or 13-6 of this code.

13-101.1 Commercial buildings.

13-101.1.1 New construction.

Subchapter 13-4, Commercial building compliance methods. Commercial buildings of any size and multiple-family residential buildings greater than three stories shall comply with Subchapter 13-4 of the code. This chapter contains three compliance methods:

Method A: Whole Building Performance Method

Method B: Building Envelope Trade-off Method

Method C: Buildings Prescriptive Envelope Method

13-101.1.2 Additions. Additions to existing commercial buildings are considered new building construction and shall comply with Subchapter 13-4 of this code as allowed in Section 101.1.1.

Additions to existing nonresidential buildings that are unable to comply with code requirements for the addition alone may comply with the code by bringing the entire building into compliance with the requirements for new buildings.

13-101.1.3 Renovations. Renovated commercial buildings shall, when applicable (see Section 202), comply with the prescriptive requirements contained in Form 400C or with Method B of Subchapter 13-4 for insulation, HVAC systems, lighting, water heating systems and exterior envelope components being retrofitted or replaced.

13-101.1.4 Buildings with multiple occupancy types. When a building contains more than one occupancy type, each portion of the building shall conform to the requirements for the occupancy housed therein.

Exceptions:

1. Where minor occupancy use does not occupy more than 5 percent of the floor area of the building, the major use shall be considered the building occupancy.
2. Residential dwelling units such as congregate living facilities that are part of a larger commercial occupancy type and are three stories or less may comply with Subchapter 13-4.

13-101.1.5 Limited or special use buildings. Buildings determined by the Florida Building Commission to have a limited energy use potential based on size, configuration or time occupied, or to have a special use requirement shall be considered limited or special use buildings and shall com-

ply with the code by Method C of Subchapter 13-4. Code compliance requirements shall be adjusted by the commission to handle such cases when warranted.

13-101.1.6 Shell buildings. Nonresidential buildings that are permitted prior to design completion or which will be finished in sections at a time after construction of the shell shall comply with either Method B or C of Subchapter 13-4 of the code prior to granting of a permit to build. All assumptions made about features not installed until later that are not on the building plans shall be listed and appended to the compliance form submitted to the building department. Unless the building is completed as per all assumptions made in the original code compliance submittal, a revised code submittal(s) using Methods A, B or C shall be submitted when completion of the building (or part of the building) is permitted.

13-101.2 Residential buildings.

13-101.2.1 New construction. New residential construction shall comply with this code by using the following compliance methods.

Subchapter 13-4, Commercial buildings compliance methods. Multiple-family buildings greater than three stories shall comply with Subchapter 13-4 of the code.

Subchapter 13-6, Residential buildings compliance methods. Single-family residential buildings and Multiple-family buildings of three stories or less shall comply with this chapter of the code. This subchapter contains three compliance methods:

Method A: Whole Building Performance Method

Method B: Component Prescriptive Method

Method C: Limited Applications Prescriptive Method

13-101.2.2 Additions. Additions to existing residential buildings shall be considered new building construction and shall comply with the requirements of either Method A, B, or C of Subchapter 13-6, as applicable. Additions to residential buildings over three stories shall comply by Subchapter 13-4.

Additions to existing residential buildings that are unable to comply with code requirements for the addition alone may comply with the code by bringing the entire building into compliance with the requirements for new buildings given in Section 101.4.2.

13-101.2.3 Renovations. Renovated buildings shall, when applicable (see Section 202), meet the prescriptive requirements contained in Method C of Subchapter 13-6 for residential applications of the code for insulation, HVAC systems, lighting, water heating systems and exterior envelope for those components being retrofitted or replaced.

13-101.2.4 Manufactured homes. Site-installed components of manufactured homes and residential manufactured buildings shall meet the prescriptive requirements contained in Method C of Subchapter 13-6 for those components.

13-101.2.5 Buildings permitted together.

13-101.2.5.1 Residences in which two buildings are permitted together that are not connected by conditioned space shall be considered separate residences for the purposes of compliance with this code if the following conditions apply:

1. The secondary building has its own bathroom and kitchenette or bar; and
2. The secondary building is heated and/or cooled by a separate heating and/or cooling system.

13-101.2.5.2 Conditioned workrooms, exercise rooms, play rooms, pool rooms and similar types of rooms that are separated from the main residence and do not meet the conditions in Section 101.2.5.1 shall use Subchapter 13-4 to demonstrate compliance with this code.

Exception: If a workroom or other room is separated from the main residence only by enclosed unconditioned space and is heated or cooled by the same system(s) as the primary building, it shall comply with this code as part of the primary building.

13-101.3 Changes of occupancy type.

13-101.3.1 Buildings having a change of occupancy type that were permitted prior to March 15, 1979, shall meet the requirements for renovations in Section 101.1.3 or Section 101.2.3, as appropriate, for those components which are being retrofitted or replaced.

13-101.3.2 Buildings having a change of occupancy that were permitted after March 15, 1979, shall comply with the requirements of Subchapter 13-4 for commercial applications and multiple-family residential buildings greater than three stories or Subchapter 13-6 for residential applications of three stories or less. Where the efficiency of a building component is unknown, it shall be determined in accordance with the criteria specified in Section 101.4.2.1.

13-101.4 Existing buildings.

13-101.4.1 Existing buildings not previously conditioned.

13-101.4.1.1 Previously unconditioned existing buildings which were permitted prior to March 15, 1979 to which heating or cooling systems are added shall meet the prescriptive requirements contained in Methods B or C of Subchapter 13-4 for commercial applications and Method C of Subchapter 13-6 for residential applications of the code for insulation, HVAC system(s), water heating system and/or exterior envelope for those components which are being retrofitted or replaced.

13-101.4.1.2 Existing buildings which were permitted after March 15, 1979 as unconditioned space to which comfort conditioning is added shall be considered additions and shall be brought into full compliance with this code.

13-101.4.2 Nonexempt existing buildings. Existing buildings not exempt from the provisions of this code (see Section 101.5.1), for either the entire building or an addition to the building, that are unable to meet one or more current prescriptive code minimum requirements may be exempt from those minimum requirements if the entire building is

brought into compliance with the following chapters and the assumptions in Section 101.4.2.1 are used:

1. Commercial buildings and residential buildings greater than three stories: Method A of Subchapter 13-4.
2. Single-family residential buildings and multiple-family buildings of three or less stories: Method A of Subchapter 13-6.

13-101.4.2.1 Assumptions for existing building efficiencies. The following restrictions apply if the entire building is used to demonstrate code compliance:

1. The owner shall demonstrate to the building department's satisfaction that all *R*-values and equipment efficiencies claimed are present. If the building was built after 1980, the original energy code submittal may be used to demonstrate efficiencies.
2. If it is apparent from inspection that no insulation is present in the existing walls, floors or ceilings, or if inspection is not possible, an *R*-value of zero (0) shall be used for that component in the calculation. If as part of the addition and renovation project, insulation or equipment in the existing structure is upgraded, the new values may be used in the calculation. Multipliers for insulation levels not on Form 600A may be found in Section 2.0 of Appendix 13-C to this chapter.
3. If, upon inspection, insulation is found but the *R*-value is unknown, then an *R*-value shall be determined by an energy audit utilizing current acceptable practice based on insulation thickness, density and type.
4. Equipment efficiencies shall be demonstrated, either from manufacturer's literature or certified equipment directories, or by the procedure provided in Section 407.1.ABC.3 or Section 607.1.ABC.3 based on system capacity and total on-site energy input. Equipment to be added shall meet the applicable minimum equipment efficiency from Tables 407.1.ABC.3.2A through 407.1.ABC.3.2D and 408.1.ABC.3.2E through 408.1.ABC.3.2G for commercial occupancies and from Tables 607.1.ABC.3.2A through 607.1.ABC.3.2D and 608.1.ABC.3.2E through 608.1.ABC.3.2F for residential occupancies. Existing equipment efficiencies not meeting the values given in Tables 407.1.ABC.3.2A through 407.1.ABC.3.2D and 408.1.ABC.3.2E through 408.1.ABC.3.2G for commercial occupancies shall utilize the cooling or heating system multipliers provided by FLA/COM. Existing residential equipment not meeting the efficiencies in Tables 607.1.ABC.3.2A through 607.1.ABC.3.2D and 608.1.ABC.3.2E through 608.1.ABC.3.2F shall utilize the cooling or heating system multipliers provided in Tables 6-16 to 6-17 of Appendix C to this chapter. Residential ducts with less than R-4.2 insulation shall use the multipliers provided in Tables 6-18 to 6-20 in Appendix 13-C to this chapter.
5. Any nonvertical roof glass shall be calculated as horizontal glazing.

13-101.5 Exempt buildings. Buildings exempt from compliance with this chapter include those described in Sections 101.5.1 through 101.5.7.

13-101.5.1 Existing buildings except those considered renovated buildings, changes of occupancy type, or previously unconditioned buildings to which comfort conditioning is added.

13-101.5.2 Any building or portion thereof whose peak design rate of energy usage for all purposes is less than 1 watt (3.4 British thermal units per hour) per square foot of floor area for all purposes.

13-101.5.3 Any building which is neither heated nor cooled by a mechanical system designed to control or modify the indoor temperature and powered by electricity or fossil fuels. Such buildings shall not contain electrical, plumbing or mechanical systems which have been designed to accommodate the future installation of heating or cooling equipment.

13-101.5.4 Any building for which federal mandatory standards preempt state energy codes.

13-101.5.5 Any historical building as described in Section 267.021, *Florida Statutes*.

13-101.5.6 Any building of less than 1,000 square feet (93 m^2) whose primary use is not as a principal residence and which is constructed and owned by a natural person for hunting or similar recreational purposes; however, no such person may build more than one exempt building in any 12-month period.

13-101.5.7 Any building where heating or cooling systems are provided which are designed for purposes other than general space comfort conditioning. Buildings included in this exemption include:

1. Buildings containing a system(s) designed and sold for dehumidification purposes only and controlled only by a humidistat. No thermostat shall be installed on systems thus exempted from this code. The provisions of Section 13-413 shall apply.
2. Commercial service areas where only ceiling radiant heaters or spot coolers are to be installed which will provide heat or cool only to a single work area and do not provide general heating or cooling for the space.
3. Buildings heated with a system designed to provide sufficient heat only to prevent freezing of products or systems. Such systems shall not provide heating above 50°F (10°C).
4. Pre-manufactured freezer or refrigerated storage buildings and areas where the temperature is set below 40°F (4°C) and in which no operators work on a regular basis.
5. Electrical equipment switching buildings which provide space conditioning for equipment only and in

which no operators work on a regular basis except that the provisions of Section 13-413 shall apply.

13-101.6 Building systems. Thermal efficiency standards are set for the following building systems where new products are installed or replaced in existing buildings, and for which a permit must be obtained. Such systems shall meet the minimum efficiencies allowed for that system on Form 400C for commercial buildings and on Form 600C for residential buildings.

1. Heating, ventilating or air conditioning systems;
2. Service water or pool heating systems;
3. Electrical systems and motors;
4. Lighting systems.

Exceptions:

1. Where part of a functional unit is repaired or replaced. For example, replacement of an entire HVAC system is not required because a new compressor or other part does not meet code when installed with an older system.
2. Where existing components are utilized with a replacement system, such as air distribution system ducts or electrical wiring for lights, such components or controls need not meet code if meeting code would require that component's replacement.
3. Replacement equipment that would require extensive revisions to other systems, equipment or elements of a building where such replacement is a like-for-like replacement, such as through-the-wall condensing units and PTACs, chillers, and cooling towers in confined spaces.
4. HVAC equipment sizing calculations are not required for systems installed in existing buildings not meeting the definition of renovation in Section 202.

SECTION 13-102
MATERIALS AND EQUIPMENT

13-102.1 Efficiency and maintenance information. An operating and maintenance manual shall be provided to the building owner for all commercial buildings. The manual shall include basic data relating to the design, operation and maintenance of HVAC systems and equipment. Required routine maintenance actions shall be clearly identified. Where applicable, HVAC controls information such as diagrams, schematics, control sequence descriptions, and maintenance and calibration information shall be included. Operations manuals shall be available for inspection by the building official upon request. See Sections 413.1.ABC.2.2 and 410.1.ABC.4.2.

13-102.2 Alternate materials–Method of construction, design or insulating systems. The provisions of this code are not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design, or insulating system has been approved by the building official and the Florida Building Commission as meeting the intent of the code. This clause shall not allow disregard of any provision(s) of the code by building departments, nor shall it prevent uniform statewide implementation of the code as required by Florida law (see Section 553.901, *Florida Statutes*).

13-102.3 Air conditioners sold or installed in Florida. All air conditioners installed in new or renovated buildings in the State of Florida shall comply with requirements set forth in Subchapters 13-4 or 13-6, as applicable.

SECTION 103
CODE COMPLIANCE AND PERMITTING

103.0 General. Code compliance for all buildings shall be certified by use of approved forms for the compliance method chosen that are specific to the climate zone in which the building will be located (see Figure 1-1).

The only software approved for determining compliance with this code shall be the software developed and maintained by the Florida Building Commission or its designated representative.

Worst-case calculations may be submitted for identical buildings facing different cardinal directions; however, original code certification signatures shall be provided for each building.

103.1 Certification of compliance. Code compliance for nonresidential and multiple-family residential applications (except for duplexes, townhouses, or other buildings identified in Sections 481.229 and 471.003, *Florida Statutes*) shall be certified by the owner, project architect (registered in the state of Florida), or other officially designated agent allowed in Section 103.2.

13-103.1.1 Code compliance preparation. The person preparing the compliance calculation shall certify that the plans and specifications covered by the calculation, or amendments thereto, are in compliance with Chapter 13 of the *Florida Building Code*.

13-103.1.1.1 Commercial applications. Completion of procedures demonstrating compliance with this code for commercial buildings shall be signed and sealed by an architect or engineer licensed to practice in the state of Florida, with the exception of buildings excluded by Section 481.229, *Florida Statutes,* or Section 471.003, *Florida Statutes*. Calculations for buildings falling within the exception of Section 471.003, *Florida Statutes,* may be performed by air conditioning or mechanical contractors licensed in accordance with Chapter 489, *Florida Statutes*, or by state of Florida certified commercial building energy raters.

Design professionals responsible under Florida law for the design of lighting, electrical, mechanical, and plumbing systems and the building shell, shall certify compliance of those building systems with the code by signing and providing their professional registration number on the energy code form provided as part of the plans and specifications to the building department.

13-103.1.1.2 Residential applications.

13-103.1.1.2.1 Single-family residential, duplexes, townhouses. No license or registration is required to

prepare the code compliance form for single-family residential dwellings, duplexes and townhouses.

13-103.1.1.2.2 Multiple-family residential. Form preparation for multiple-family dwellings except duplexes and townhouses shall be signed and sealed by an architect or engineer registered in the state of Florida, with the exception of buildings excluded by Section 481.229, *Florida Statutes*, or Section 471.003, *Florida Statutes*. Calculations for buildings falling within the exception of Section 471.003, *Florida Statutes*, may be performed by air conditioning or mechanical contractors licensed in accordance with Chapter 489, *Florida Statutes*, by state of Florida certified commercial building energy raters.

13-103.1.2 Code compliance certification. The building's owner, the owner's architect, or other authorized agent legally designated by the owner shall certify that the building is in compliance with the code, as per Section 553.907, *Florida Statutes*, prior to receiving the permit to begin construction or renovation.

If, during the building's construction or renovation, alterations are made in the building's design or in materials or equipment installed in the building which would diminish its energy performance, an amended copy of the compliance certification shall be submitted to the building official on or before the date of final inspection by the building owner or his or her legally authorized agent.

13-103.2 Details, plans and specifications. Plans and specifications shall be submitted with each application for a building permit. Energy code calculations shall be made a part of the plans and specifications of the building. The building official shall require, subject to the exceptions in Section 481.229, *Florida Statutes*, and Section 471.003, *Florida Statutes*, that plans and specifications be prepared by an engineer or architect licensed to practice in the state of Florida. The plans and specifications, including the energy code calculations, shall show, in sufficient detail, all pertinent data and features of the building and the equipment and systems as herein governed including, but not limited to: design criteria, exterior envelope component materials, *U*-values of the envelope systems, *R*-values of insulating materials, size and type of apparatus and equipment, equipment and systems controls and other pertinent data to indicate conformance with the requirements of the code.

13-103.3 Building permits. Prior to receiving the permit to begin construction or renovation, owners, or an agent duly designated by the owner, of all buildings shall certify energy code compliance to the designated local enforcement agency. If, during the building construction or renovation, alterations are made in the design, materials, or equipment which would diminish the energy performance of the building, an amended copy of the compliance certifications shall be submitted to the local enforcement agency on or before the date of final inspection by the building owner or his or her agent.

Building officials or their officially designated representatives shall assure that the compliance forms are complete and without gross errors.

SECTION 13-104
INSPECTIONS

13-104.1 General. All construction or work for which a permit is required shall be subject to inspection by the building official or his or her officially designated representative.

13-104.2 Approvals required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the building official. No construction shall be concealed without inspection approval.

13-104.3 Inspections required. There shall be a final inspection for code compliance on all buildings when completed and ready for occupancy.

13-104.4 Information cards required.

13-104.4.1 Energy performance level (EPL) display card. The building official shall require that an energy performance level (EPL) display card be completed and certified by the builder to be accurate and correct before final approval of the building for occupancy. Florida law (Section 553.9085, *Florida Statutes*) requires the EPL display card to be included as an addendum to each sales contract executed after January 1, 1994, for both presold and nonpresold residential buildings.

The EPL display card contains information indicating the energy performance level and efficiencies of components installed in a dwelling unit. The building official shall verify that the EPL display card completed and signed by the builder accurately reflects the plans and specifications submitted to demonstrate code compliance for the building.

13-104.4.2 HVAC efficiency card. The building official shall require that a completed HVAC efficiency card signed by a representative of the heating and cooling equipment contractor be posted in a prominent location on the cabinet of the indoor air handler or furnace of each heating or heating and cooling system installed in the building at the time of installation. Where single package units are installed, the card shall be posted on the unit itself. The card shall be durable, readable and shall contain the following information:

1. Manufacturer's name(s);
2. Brand name(s);
3. Model numbers of the furnace, compressor unit, and air handler (and evaporator coil, if the air handler can be equipped with more than one coil) for each system installed;
4. Efficiency ratings of the combined equipment for each system actually installed;
5. Name and address of the heating and or cooling company installing the equipment;
6. Signature line and date line, preceded by the statement, "With the authorization of the installing contractor I certify that the information entered on this card accurately represents the system installed."
7. Signature line and date line, preceded by the statement, "As the building official or the representative of the building official I certify that the information en-

tered on this card accurately represents the system installed."

Exceptions:

1. If the information required above has been previously submitted and is included on the plans required at the building site, the HVAC efficiency card need not be provided. However, the plans shall be signed by a representative of the heating and cooling company installing the equipment and shall be available for inspection by building inspectors and by prospective buyers until the time of title transfer.
2. The Federal Trade Commission's energy guide label may be used to fulfill this requirement.

13-104.4.3 Insulation certification card. In cases where the *R*-value of insulation installed in either walls, ceilings or floors is not readily apparent, the local building official shall require that an *R*-value certification card signed by the insulation contractor be posted in a prominent location at the time of installation. The card shall contain, at a minimum, the following information:

1. Insulation manufacturer's name;
2. Insulation type;
3. *R*-value of insulation installed;
4. Thickness of insulation installed;
5. Location of insulation installed;
6. Indication that the installation has been checked and does not block attic ventilation.
7. Name and address of the contractor installing the insulation;
8. Date of installation.

13-104.4.4 Energy guide labels. Energy guide labels required by the U.S. Federal Trade Commission for heating and cooling systems, water heaters and other appliances covered by federal law shall remain on those appliances until time of title transfer.

13-104.4.5 Fenestration energy rating labels. Energy performance values (i.e., *U*-factor, solar heat gain coefficient) of fenestration products (i.e., windows, doors and skylights) shall be determined y an accredited, independent laboratory and labeled and certified by the manufacturer. Such certified and labeled fenestration energy ratings shall be accepted for the purposes of determining compliance with the building envelope requirements of this code.

Where the specified energy performance (*U*-factor or SHGC) of the fenestration product is not labeled nor readily apparent, the default procedures outlined in Tables B-6, B-7 and B-8 of Appendix B for *U*-factor and SHGC shall be used to determine code compliance for commercial applications and in Section 601.1.ABC.1 for residential applications. Product features must be verifiable for the product to qualify for the default value associated with those features. Where the existence of a particular feature cannot be determined with reasonable certainty, the product shall not receive credit for that feature. Where a composite of materials from two different product types are used, the product shall be assigned the worst value.

U-factors (thermal transmittances) of fenestration products (windows, doors and skylights) shall be determined by an accredited, independent laboratory in accordance with NFRC 100: *Procedure for Determining Fenestration Product U-Factors*. The SHGC for glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200: *Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence*.

SECTION 13-105
REPORTING

13-105.0 Reporting to the department of community affairs. A reporting form shall be submitted to the local building department by the owner or owner's agent with the submittal certifying compliance with this code. Reporting forms shall be a copy of the front page of the form applicable for the code chapter under which compliance is demonstrated.

13-105.1 Reporting schedule. It shall be the responsibility of the local building official to forward the reporting section of the proper form to the Department of Community Affairs on a quarterly basis as per the reporting schedule in Table 13-105.1.

TABLE 13-105.1
REPORTING SCHEDULE

	Group I*	Group II*	Group III*
Quarter 1	12/31	1/31	2/28
Quarter 2	3/31	4/30	5/31
Quarter 3	6/30	7/31	8/31
Quarter 4	9/30	10/31	11/30

*See Appendix A of this chapter for group designations.

13-105.2 Jurisdiction numbers. For data collection purposes, all permitting jurisdictions in the state of Florida have been assigned a six-digit jurisdiction number. The jurisdiction number is required on all energy code forms. Jurisdiction numbers are listed by county in Appendix 13-A.

SECTION 13-106
VALIDITY

13-106.0 Validity. If any section, subsection, sentence, clause, or phrase of this code is, for any reason, held to be invalid for any reason, such decision shall not affect the validity of the remaining portions of this code.

SUBCHAPTER 13-1

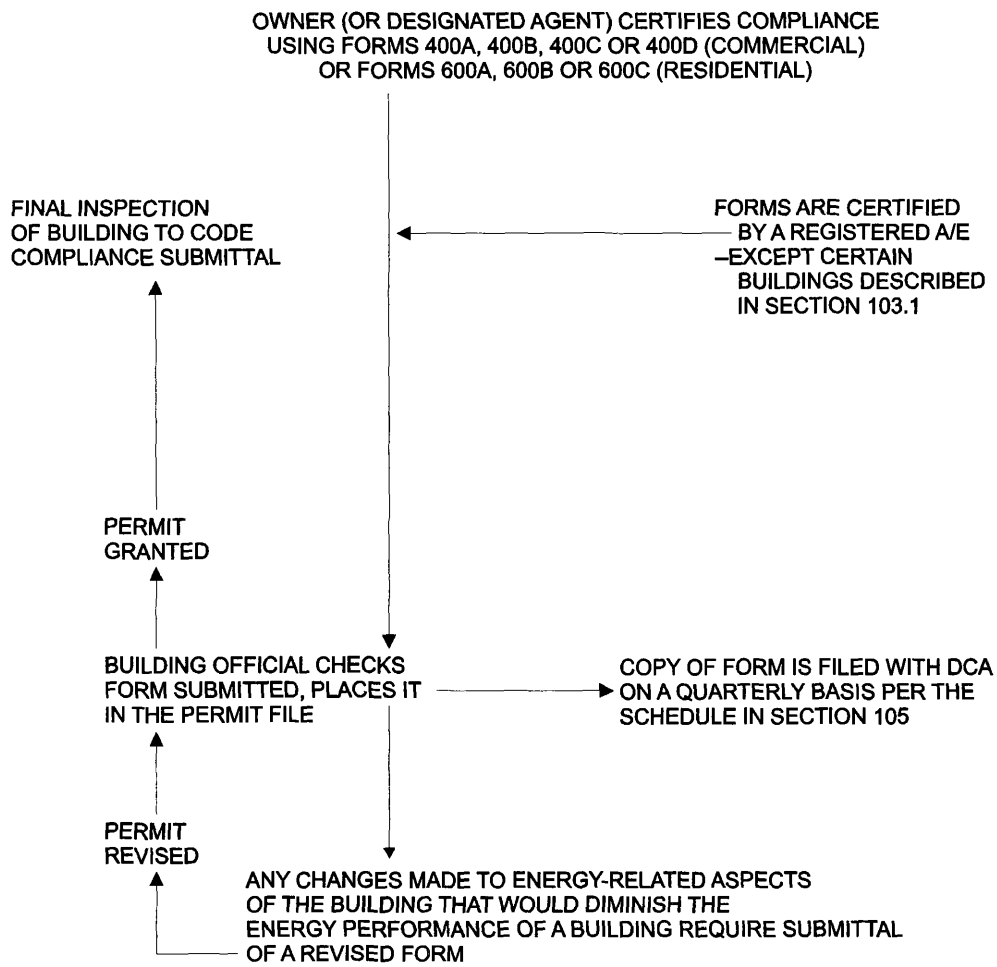


FIGURE 1-1
CODE COMPLIANCE CHART

SUBCHAPTER 13-2

DEFINITIONS

SECTION 13-201
GENERAL

13-201.1 Application of terms. For the purpose of this code, certain abbreviations, terms, phrases, words, and their derivatives, shall be construed as set forth in this chapter.

13-201.2 Words not defined. Words not defined herein shall have the meanings stated in the *Webster's Ninth New Collegiate Dictionary*, as revised.

SECTION 13-202
DEFINITIONS

ABOVE-GRADE WALL. See "Wall."

ACCESS HATCH. See "Door."

ACCESSIBLE (as applied to equipment). Admitting close approach; not guarded by locked doors, elevation or other effective means (see "Readily accessible").

ADDITION. An extension or increase in conditioned floor area or height of a building or structure.

ADJACENT WALL, CEILING or FLOOR. A wall, ceiling or floor of a structure that separates conditioned space from enclosed but unconditioned space, such as an unconditioned attached garage, storage or utility room.

ADJUSTED LIGHTING POWER (ALP). Lighting power, assigned to a luminaire(s), that has been reduced by deducting a lighting power control credit based on use of an automatic control device(s).

AEROSOL SEALANT. A closure product for duct and plenum systems, which is delivered internally to leak sites as aerosol particles using a pressurized air stream.

AFUE (ANNUAL FUEL UTILIZATION EFFICIENCY). The ratio of annual output energy to annual input energy including any nonheating season pilot input loss.

AIR BARRIER. Relating to air distribution systems, a material object(s) which impedes or restricts the free movement of air under specified conditions. For fibrous glass duct, the air barrier is its foil cladding; for flexible nonmetal duct, the air barrier is the nonporous core; and for sheet metal duct and air handling units, the air barrier is the metal in contact with the air stream. For mechanical closets, the air barrier may be a uniform panelized material such as gypsum wall board which meets ASTM C 36, or it may be a membrane which alone acts as an air barrier which is attached to a panel, such as the foil cladding of fibrous glass duct board.

Relating to the building envelope, air barriers comprise the planes of primary resistance to air flow between the interior spaces of a building and the outdoors and the planes of primary air flow resistance between adjacent air zones of a building, including planes between adjacent conditioned and unconditioned air spaces of a building. To be classed as an air barrier, a building plane must be substantially leak free; that is, it shall have an air leakage rate not greater than 0.5 cfm/ft^2 when subjected to an air pressure gradient of 25 pascal. In general, air barriers are made of durable, nonporous materials and are sealed to adjoining wall, ceiling or floor surfaces with a suitable long-life mastic. House wraps and taped and sealed drywall may constitute an air barrier but dropped acoustical tile ceilings (T-bar ceilings) may not. Batt insulation facings and asphalt-impregnated fiberboard and felt paper are not considered air barriers.

AIR CONDITIONING. The process of treating air to control its temperature, humidity, cleanliness and distribution to meet requirements of the conditioned space.

AIR DISTRIBUTION SYSTEMS. Include all building elements (duct systems, air handling units, cavities of the building structure and mechanical closets) through which air is delivered to or from the conditioned spaces.

AIR DUCT. A passageway for conducting air to or from heating, cooling, air conditioning, or ventilating equipment, but not including the plenum. For material requirements see local mechanical codes.

AIR-HANDLING UNIT. The fan unit of a furnace and the fan-coil unit of a split-system, packaged air conditioner or heat pump.

AIR INFILTRATION. See "Infiltration."

AIR POROSITY. The ability to transmit air through minute openings in a substance or material.

ALTERATION. Replacement or addition to a building or its systems and equipment; routine maintenance, repair, and service or a change in the building's use classification or category shall not constitute an alteration.

ANNUAL FUEL UTILIZATION EFFICIENCY. Efficiency descriptor of the ratio of annual output energy to annual input energy as developed in accordance with the requirements of U.S. Department of Energy (DOE) 10CFR Part 430.

APPLICATION PART-LOAD VALUE (APLV). A single number part-load efficiency figure of merit calculated in accordance with the method described in ARI 550 or 590 referenced to modified rating conditions described in those standards.

AS-BUILT. Building components to be actually installed in a structure. In some cases, this may be a worst-case condition (see "Worst case").

ASHRAE CLIMATE ZONE 1. Broward, Miami-Dade and Monroe Counties.

ASHRAE CLIMATE ZONE 2. All of Florida except Broward, Miami-Dade and Monroe Counties.

ATTIC. An enclosed unconditioned space located immediately below an uninsulated roof and immediately above the ceiling of a building. For the roof to be considered insulated, roof insulation shall be at least the *R*-value required to meet section 13-404.ABC.1 in Subchapter 4 and Section 13-604.ABC.1 in Subchapter 6 (see "Under Attic;" "Roof").

ATTIC RADIANT BARRIER. See "Radiant barrier."

AUTHORITY HAVING JURISDICTION. The agency or agent responsible for enforcing this standard.

AUTOMATIC. Self-acting, operating by its own mechanism when actuated by some nonmanual influence, such as a change in current strength, pressure, temperature, or mechanical configuration (see "Manual").

AUTOMATIC CONTROL DEVICE. A device capable of automatically turning loads off and on without manual intervention.

BALANCING, AIR SYSTEM. adjusting air flow rates through air distribution system devices, such as fans and diffusers, by manually adjusting the position of dampers, splitter vanes, extractors, etc., or by using automatic control devices, such as constant air volume or variable air volume boxes.

BALANCING, HYDRONIC. Adjusting water flow rates through hydronic distribution system devices, such as pumps and coils, by manually adjusting the position valves, or by using automatic control devices, such as automatic flow control valves.

BALLAST. A device used in conjunction with an electric discharge lamp to cause the lamp to start and operate under the proper circuit conditions of voltage, current, wave form, electrode heat, etc.

(a) **Electronic ballast**: A ballast constructed using electronic circuitry.

(b) **Hybrid ballast:** A ballast constructed using a combination of magnetic core and insulated wire winding and electronic circuitry.

(c) **Magnetic ballast:** A ballast constructed with magnetic core and a winding of insulated wire.

BASELINE. Building component performance target or the total building performance target which is compared with the as-built building performance.

BEDROOM. Any residential room which has an area of 70 square feet (7 m^2) or more and a clothes storage closet, and is not part of the common living area. For the purposes of this code, the number of "main" bedrooms for homes of three bedrooms or more is the total number of bedrooms less one. In one and two bedroom homes, all bedrooms are "main" bedrooms.

BELOW-GRADE WALL. See "Wall."

BOILER. A self-contained low-pressure appliance for supplying steam or hot water.

BOILER CAPACITY. The rate of heat output in Btu/h of the boiler, at the design inlet and outlet conditions and rated fuel or energy input, measured at the boiler outlet, at the design pressure and/or temperature, and rated fuel input.

BOILER, PACKAGED. A boiler that is shipped complete with heating equipment, mechanical draft equipment and automatic controls usually in one or more sections. A packaged boiler includes factory-built boilers manufactured as a unit or system, disassembled for shipment, and reassembled at the site.

BRANCH CIRCUIT. The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s); the final wiring run to the load.

BUDGET (Baseline). Building design: a computer representation of a hypothetical design based on the actual proposed building design. This representation is used as the basis for calculating the Method A energy cost budget.

BTU (British Thermal Unit). The standard unit for measuring heat energy, such as the heat content of fuel. It is the amount of heat energy necessary to raise the temperature of one pound of water one degree Fahrenheit. 1 BTU per minute = 17.6 watts.

BTU. Per kilowatt hour (see "Heat rate").

BUILDING. Any structure that includes provision for any of the following or any combination of the following: a space heating system, a space cooling system, or a service water heating system. For each purpose of this code each portion of a building separated from other portions by a rated fire wall shall be considered as a separate building. The term "building" shall be construed as if followed by the words "or part thereof."

BUILDING CONSTRUCTION. Any new building or structure or addition to any existing building or structure.

BUILDING ENTRANCE. Any doorway, set of doors, turnstiles, or other form of portal that is ordinarily used to gain access to the building by its users and occupants.

BUILDING ENVELOPE. The exterior plus the semiexterior portions of a building. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Building envelope, exterior:** The elements of a building that separate conditioned spaces from the exterior.

(b) **Building envelope, semiexterior:** The elements of a building that separate conditioned space from unconditioned space or that enclose semiheated spaces through which thermal energy may be transferred to or from the exterior, or to or from unconditioned spaces, or to or from conditioned spaces.

BUILDING EXIT. Any doorway, set of doors, or other form of portal that is ordinarily used only for emergency egress or convenience exit.

BUILDING GROUNDS LIGHTING. Lighting provided through a building's electrical service for parking lot, site, roadway, pedestrian pathway, loading dock and security applications.

BUILDING MATERIAL. Any element of the building envelope through which heat flows and that is included in the component *U*-factor calculations other than air films and insulation.

BUILDING OFFICIAL. The officer or other designated representative authorized to act on behalf of the authority having jurisdiction.

BUILDING SYSTEMS. See "System."

C-FACTOR (Thermal conductance). Time rate of steady state heat flow through unit area of a material or construction, induced by a unit temperature difference between the body surfaces. Units of C are Btu/h·ft^{2}·°F. Note that the C-factor does not include soil or air films.

CIRCUIT BREAKER. A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically at a predetermined overcurrent without damage to itself when properly applied within its rating.

CLASS OF CONSTRUCTION. For the building envelope, a subcategory of roof, above-grade wall, below-grade wall, floor, slab-on-grade floor, opaque door, vertical fenestration, or skylight (see "Roof," "Wall," "Floor," "Slab-on-grade floor," "Door" and "Fenestration").

CLERESTORY. That part of a building that rises clear of the roofs or other parts and whose walls contain windows for lighting the interior.

CODE OFFICIAL. See "Building official."

COEFFICIENT OF PERFORMANCE (COP) – COOLING. The ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.

COEFFICIENT OF PERFORMANCE (COP) – (HEAT PUMP) – HEATING. Heating: the ratio of the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system, including the compressor and, if applicable, auxiliary heat, under designated operating conditions.

COMBUSTION APPLIANCE, DIRECT VENT. A system consisting of: (1) an appliance for indoor installation; (2) combustion air connections between the appliance and the outdoor atmosphere; (3) flue gas connections between the appliance and the vent cap; and (4) vent cap for installation outdoors, supplied by the manufacturer and constructed so that all air for combustion is obtained from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere.

COMFORT CONDITIONING. Treating air to control its temperature, relative humidity, cleanliness, and distribution to meet the comfort requirements of the occupants of the conditioned space.

COMFORT ENVELOPE. The area on a psychrometric chart enclosing all those conditions described as being comfortable in Figure 1, ASHRAE 55, *Thermal Environmental Comfort Conditions for Human Occupancy.*

COMMON CEILING. The ceiling/floor assembly separating conditioned tenancies, one above the other.

COMMON WALL. A wall separating conditioned tenancies, one next to the other.

CONDITIONED FLOOR AREA. The horizontal projection (outside measurements) of that portion of space which is conditioned directly or indirectly by an energy-using system (see "Floor area;" "Gross floor area".)

CONDITIONED SPACE. That volume of a structure which is either mechanically heated, cooled, or both heated and cooled by direct means. Spaces within the thermal envelope that are not directly conditioned shall be considered buffered unconditioned space. Such spaces may include, but are not limited to, mechanical rooms, stairwells, and unducted spaces beneath roofs and between floors. Air leakage into dropped ceiling cavities does not constitute conditioned space (see "Space.")

CONDUCTANCE. See "Thermal conductance."

CONSTRUCTION. The fabrication and erection of a new building or any addition to or alteration of an existing building.

CONSTRUCTION DOCUMENTS. Drawings and specifications used to construct a building, building systems, or portions thereof.

CONTINUOUS INSULATION (cont. ins. or ci). Insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope.

CONTROL. To regulate the operation of equipment.

CONTROL DEVICE. A specialized device used to regulate the operation of equipment.

CONVENTIONAL ATTIC. Traditionally, the space directly below the roof and above the ceiling of the upper story of a building.

COOL DOWN. Reduction of space temperature down to occupied set point after a period of shutdown or setup.

COOLED SPACE. See "Space."

COOLING DEGREE DAY. See "Degree-day."

COOLING DESIGN TEMPERATURE. The outdoor dry-bulb temperature equal to the temperature that is exceeded 1 percent of the number of hours during a typical weather year.

COOLING DESIGN WET-BULB TEMPERATURE. The outdoor wet bulb temperature for sizing cooling systems and evaporative heat rejection systems such as cooling towers.

DEAD BAND. The range of values within which a sensed variable can vary without initiating a change in the controlled process.

DECORATIVE LIGHTING. See "Lighting, decorative."

DEGREE DAY. The difference in temperature between the outdoor mean temperature over a 24-hour period and a given base temperature. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) Cooling degree day base 50°F (10°C), CDD 50: for any one day, when the mean temperature is more than 50°F (10°C), there are as many degree days as degrees Fahrenheit temperature difference between the mean temperature for the day and 50°F (10°C). Annual cooling degree days (CDDs) are the sum of the degree-days over a calendar year.

(b) Heating degree day base 65°F (18°C), HDD 65: for any one day, when the mean temperature is less than 65°F (18°C), there are as many degree days as degrees Fahrenheit temperature difference between the mean temperature for the day and 65°F (18°C). Annual heating degree days (HDDs) are the sum of the degree days over a calendar year.

DEMAND. The highest amount of power (average Btu/h over an interval) recorded for a building or facility in a selected time frame.

DESIGN CAPACITY. Output capacity of a system or piece of equipment at design conditions.

DESIGN CONDITIONS. Specified environmental conditions, such as temperature and light intensity, required to be produced and maintained by a system and under which the system must operate.

DESIGN ENERGY COST. The annual energy cost calculated for a proposed design.

DESIGN PROFESSIONAL. An architect or engineer licensed to practice in accordance with applicable state licensing laws.

DIRECT DIGITAL CONTROL (DDC). A type of control where controlled and monitored analog or binary data (e.g., temperature, contact closures) are converted to digital format for manipulation and calculations by a digital computer or microprocessor, then converted back to analog or binary form to control physical devices.

DISCONNECT. A device or group of devices or other means by which the conductors of a circuit can be disconnected from their source of supply.

DISTRIBUTION SYSTEM. Conveying means, such as ducts, pipes, and wires, to bring substances or energy from a source to the point of use. The distribution system includes such auxiliary equipment as fans, pumps, and transformers.

DOOR. All operable opening areas (which are not fenestration) in the building envelope, including swinging and roll-up doors, fire doors, and access hatches. Doors that are more than one-half glass are considered fenestration. (See "Fenestration"). For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Nonswinging**. Roll-up, sliding, and all other doors that are not swinging doors.

(b) **Swinging.** All operable opaque panels with hinges on one side and opaque revolving doors.

DOOR AREA. Total area of the door measured using the rough opening and including the door slab and the frame (see "Fenestration area").

DRAWBAND. A fastener which surrounds and fastens a duct fitting with either the inner lining or the outer jacket of flexible ducts. Tension ties, clinch bands, draw ties, and straps are considered drawbands.

DUCT FITTING. Couplings that join sections of ducting together or to other air distribution system components. When used to join sections of flexible nonmetal duct, duct fittings are typically metal or other rigid material and have a raised bead or indented groove against which the drawband is secured. Terminal fittings join ducting to supply outlets and return inlets at the end of the distribution system and include register and return boots and register and return boxes. Intermediate fittings join flexible nonmetal duct to other sections of flexible nonmetal duct, to sections of other types of ducting, and to mechanical equipment and include collars, take-offs, tap-ins, sleeves, and the supply and return ends of air handlers and furnaces (see "Integral flange duct collar fitting").

DUCTS IN CONDITIONED SPACE. Ductwork located on the conditioned side of the envelope insulation and constructed in such a manner that any leakage will be discharged into the conditioned space.

DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

ECONOMIZER, AIR. A duct and damper arrangement and automatic control system that together allow a cooling system to supply outside air to reduce or eliminate the need for mechanical cooling during mild or cold weather.

ECONOMIZER, WATER. A system by which the supply air of a cooling system is cooled indirectly with water that is itself cooled by heat or mass transfer to the environment without the use of mechanical cooling.

EFFECTIVE AIR SPACE EMITTANCE. The radiation heat transfer property E of an air space determined by the emissivity of the surfaces bounding that air space (see the 2001 ASHRAE *Handbook of Fundamentals*, Chapter 38, Table 3).

EFFICIENCY. Performance at specified rating conditions.

EFFICIENCY, HVAC SYSTEM. The ratio of useful energy output (at the point of use) to the energy input in consistent units for a designated time period, expressed in percent.

ELECTRIC METER. A mechanical/electrical device that can measure electric power.

ELECTRIC SUPPLIER. An agency that sells and/or distributes electric power.

EMERGENCY POWER SYSTEM. A system that is required by codes or other laws to automatically supply illumination or power or both in the event of failure of the normal supply or in the event of accidents to such systems. Such systems may also include standby loads incidental to system operations but shall not include systems for optional standby loads only.

EMISSIVITY. The ratio of the total radiant flux emitted by a body to that emitted by an ideal black body at the same temperature.

EMITTANCE. The ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions.

ENCLOSED SPACE. A volume substantially surrounded by solid surfaces such as walls, floors, roofs and openable devices such as doors and operable windows.

ENCLOSED SUPPORT PLATFORM. A framed enclosure located inside or outside the conditioned space, which supports

a furnace or central heating/air conditioning air handler and which may contain and protect a return duct section of the air distribution system.

ENCLOSURE. The case or housing of an apparatus, or the fence or walls surrounding an installation, to prevent personnel from accidentally contacting energized parts or protect equipment from physical damage.

ENERGY. The capacity for doing work. It takes a number of forms that may be transformed from one into another such as thermal (heat), mechanical (work), electrical, and chemical. Customary measurement units are British thermal units (Btu).

ENERGY COST BUDGET. The annual energy cost for the budget building.

ENERGY EFFICIENCY RATIO (EER). The ratio of net cooling capacity in Btu/h to total rate of electric input in watts under designated operating conditions [see "Coefficient of performance (COP) —cooling"].

ENERGY FACTOR (EF). A measure of water heater overall efficiency.

ENERGY MANAGEMENT SYSTEM. A control system designed to monitor the environment and the use of energy in a facility and to adjust the parameters of local control loops to conserve energy while maintaining a suitable environment.

ENERGY PERFORMANCE LEVEL. An indicator of the energy-related performance of a building, including, but not limited to, the levels of insulation, the amount and type of glass, and the HVAC and water heating system efficiencies.

ENERGY, RECOVERED. See "Recovered energy."

ENVELOPE PERFORMANCE FACTOR. The trade-off value for the building envelope performance compliance option calculated using the procedures specified in Appendix 13-B for Compliance Methods B and C. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Base envelope performance factor:** The building envelope performance factor for the base design.

(b) **Proposed envelope performance factor:** The building envelope performance factor for the proposed design.

EQUIPMENT. Devices for comfort conditioning, electric power, lighting, transportation, or service water heating including, but not limited to, furnaces, boilers, air conditioners, heat pumps, chillers, water heaters, lamps, luminaires, ballasts, elevators, escalators or other devices or installations.

EXISTING BUILDING. A building or portion thereof that was previously occupied or approved for occupancy by the authority having jurisdiction.

EXISTING EQUIPMENT. Equipment previously installed in an existing building.

EXISTING SYSTEM. A system or systems previously installed in an existing building.

EXFILTRATION. Uncontrolled outward air leakage from inside a building including leakage through cracks and interstices around windows and doors and through any other exterior partition or penetration.

EXTERIOR BUILDING ENVELOPE. See "Building envelope."

EXTERIOR LIGHTING POWER ALLOWANCE. See "Lighting power allowance."

EXTERIOR WALL. A wall of a structure that is exposed to outdoor climate conditions and which forms a boundary between a conditioned and an outdoor space (see "Adjacent wall").

FACADE AREA. Area of the facade, including overhanging soffits, cornices, and protruding columns, measured in elevation in a vertical plane parallel to the plane of the face of the building. Nonhorizontal roof surfaces shall be included in the calculation of vertical facade area by measuring the area in a plane parallel to the surface.

F-FACTOR. The perimeter heat loss factor for slab-on-grade floors, expressed in Btu/h·ft·°F.

FACTORY-SEALED AIR HANDLING UNIT. A furnace, or an air conditioner or heat pump fan-coil unit which is certified by its manufacturer to withstand, without leakage, an air pressure of 1-inch water gauge, when all air inlets, air outlets and condensate drain port(s), when present, are sealed at an air pressure of 1-inch water gauge with no greater than 2 design CFM discharge.

FAN SYSTEM ENERGY DEMAND (or FAN SYSTEM POWER). The sum of the nominal power demand (nameplate horsepower) of motors of all fans that are required to operate at design conditions to supply air from the heating or cooling source to the conditioned space(s) and return it to the source or exhaust it to the outdoors.

FEEDER CONDUCTORS. The wires that connect the service equipment to the branch circuit breaker panels.

FENESTRATION. All areas (including the frames) in the building envelope that let in light, including windows, plastic panels, clerestories, skylights, glass doors that are more than one-half glass, and glass block walls (see "Building envelope" and "Door").

(a) **Skylight:** A fenestration surface having a slope of less than 60 degrees from the horizontal plane. Other fenestration, even if mounted on the roof of a building, is considered vertical fenestration.

(b) **Vertical fenestration:** All fenestration other than skylights. Trombe wall assemblies, where glazing is installed within 12 inches (305 mm) of a mass wall, are considered walls, not fenestration.

FENESTRATION AREA. Total area of the fenestration measured using the rough opening and including the glazing, sash, and frame. For doors where the glazed vision area is less than 50 percent of the door area, the fenestration area is the glazed vision area. For all other doors, the fenestration area is the door area (see "Door area").

FENESTRATION, VERTICAL. See "Fenestration;" "Skylight."

FIRE WALL. Fire-resistant wall, having protective openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient

structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

FIXTURE. The component of a luminaire that houses the lamp or lamps, positions the lamp, shields it from view, and distributes the light. The fixture also provides for connection to the power supply, which may require the use of a ballast.

FLEXIBLE NONMETAL DUCT. A type of flexible air duct comprised of a wire-reinforced core (usually plastic), an insulation layer and an outer jacket (usually a durable reinforced plastic).

FLOODLIGHTING. A lighting system designated to light an area using projector-type luminaries usually capable of being pointed in any direction.

FLOOR, ENVELOPE. That lower portion of the building envelope, including opaque area and fenestration, that has conditioned or semiheated space above and is horizontal or tilted at an angle of less than 60 degrees from horizontal but excluding slab-on-grade floors. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Mass floor:** A floor with a heat capacity that exceeds (1) 7 Btu/ft^2·°F or (2) 5 Btu/ft^2·°F provided that the floor has a material unit mass not greater than 120 pound per cubic foot (lb/ft^3)(1922 kg/m^3)

(b) **Steel joist floor:** A floor that (1) is not a mass floor and (2) that has steel joist members supported by structural members.

(c) **Wood framed and other floors:** All other floor types, including wood joist floors (see "Building envelope," "Fenestration," "Opaque area," and "Slab-on-grade floor").

FLOOR AREA, GROSS. The sum of the floor areas of the spaces within the building including basements, mezzanine and intermediate-floored tiers, and penthouses with headroom height of 7.5 feet (2286 mm) or greater. It is measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, but excluding covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, and similar features.

(a) **Gross building envelope floor area:** The gross floor area of the building envelope, but excluding slab-on-grade floors.

(b) **Gross conditioned floor area:** The gross floor area of conditioned spaces.

(c) **Gross lighted floor area:** The gross floor area of lighted spaces.

(d) **Gross semiheated floor area:** The gross floor area of semiheated spaces (see "Building envelope," "Floor," "Slab-on-grade floor" and "Space").

FLUE DAMPER. A device in the flue outlet or in the inlet of or upstream of the draft control device of an individual, automatically operated, fossil fuel-fired appliance that is designed to automatically open the flue outlet during appliance operation and to automatically close the flue outlet when the appliance is in a standby condition.

FOSSIL FUEL. Fuel derived from a hydrocarbon deposit such as petroleum, coal or natural gas derived from living matter of a previous geologic time.

FUEL. A material that may be used to produce heat or generate power by combustion.

GASKETING. A compressible, resilient elastic packing, made of foam rubber or of a synthetic foam polymer. A gasket is distinct from the components being joined and must be capable of closing all air leakage pathways between the air barriers of the joint and of creating an air-tight seal.

GENERAL LIGHTING. See "Lighting, general."

GENERALLY ACCEPTED ENGINEERING STANDARD. A specification, rule, guide, or procedure in the field of engineering, or related thereto, recognized and accepted as authoritative.

GLAZED WALL SYSTEM. A category of site-assembled fenestration products, which includes, but is not limited to, curtainwalls and solariums.

GLAZING. Sunlight-transmitting fenestration, including the area of a sash, curbing or other framing elements, that enclose a conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements.

GRADE. The finished ground level adjoining a building at all exterior walls.

GROSS FLOOR AREA. The sum of the floor areas of the conditioned spaces including basements, mezzanine and intermediate-floored tiers and penthouses of headroom height 7.5 feet (2286 mm) or greater. It is measured from the exterior faces of exterior walls or from the centerline of walls separating buildings.

GROSS LIGHTED AREA (GLA). See "Floor area, gross;" "Gross lighted floor area."

GROSS ROOF AREA. See "Roof area, gross."

GROSS WALL AREA. See "Wall area, gross."

HEAT. The form of energy that is transferred by virtue of a temperature difference or a change in the state of a material.

HEAT CAPACITY (HC): The amount of heat necessary to raise the temperature of a given mass 1°F (-17°C). Numerically, the sum of the products of the mass per unit area of each individual material in the roof, wall, or floor surface multiplied by its individual specific heat (Btu/ft^2·°F).

HEAT TRACE. A heating system where the externally applied heat source follows (traces) the object to be heated, e.g., water piping.

HEAT PUMP. A mechanical refrigeration-cycle system which has been designed to accomplish space heating, water heating or both and, when the evaporator and condenser effects are reverse, may be used for space air conditioning or water chilling.

HEAT TRAP. A device or arrangement of the hot water piping leaving the water heater, constructed to counteract the convective forces of the heated water (thermosyphoning) during stand-by periods.

HEATED BUILDING. Any building with heating equipment installed at the time of construction, or designed for the future installation of heating equipment, using electricity or fossil fuels.

HEATED SLAB. A floor, usually constructed of concrete, that has heat energy supplied into the slab to provide heating to an interior space.

HEATED SPACE. See "Space."

HEATING DESIGN TEMPERATURE. The outdoor dry-bulb temperature equal to the temperature that is exceeded at least 99.6 percent of the number of hours during a typical weather year.

HEATING DEGREE DAY. See "Degree day."

HEATING SEASONAL PERFORMANCE FACTOR (HSPF). The total heating output of a heat pump during its normal annual usage period for heating (in Btu) divided by the total electric energy input during the same period.

HISTORIC. A building or space that has been specifically designated as historically significant by the adopting authority or is listed in the National Register of Historic Places or has been determined to be eligible for listing by the U.S. Secretary of the Interior.

HOME INSULATION. Any material, mainly insulation, used to retard the flow of heat through the building envelope that is tested and labeled with an installed *R*-value as required by the Federal Trade Commission rules, 16 U.S. Code of Federal Regulations (CFR) Part 460.

HORSEPOWER (HP). Unit of power; work done at a rate equal to 745.7 Watts, 550 foot pound per second or 33,000 foot pound per minute.

HOT WATER SUPPLY BOILER. A boiler used to heat water for purposes other than space heating.

HUMIDISTAT. An automatic control device used to maintain humidity at a fixed or adjustable set point.

HVAC. Heating, ventilating and air conditioning.

HVAC SYSTEM. The equipment, distribution systems, and terminals that provide, either collectively or individually, the processes of heating, ventilating, or air conditioning to a building or portion of a building.

INDIRECTLY CONDITIONED SPACE. See "Space."

INDOOR. Within the conditioned building envelope.

INFILTRATION. The uncontrolled inward air leakage through cracks and crevices in any building element and around windows and doors of a building caused by pressure differences across these elements due to factors such as wind, inside and outside temperature differences (stack effect), and imbalance between supply and exhaust air systems.

INFILTRATION BARRIER. A product or system designed to limit the free passage of air through a building envelope component (wall, ceiling or floor). Such products and systems are sealed together to form a continuous barrier against air infiltration.

INSTALLED INTERIOR LIGHTING POWER. The power in watts of all permanently installed general, task, and furniture lighting systems and luminaires.

INSULATION. Material mainly used to retard the flow of heat (see "Home insulation").

INSULATION BAFFLE. A device installed at the eave of an attic to prevent insulation from blocking the air flow channel between the soffits and attic.

INSULATION CHUTE. See "Insulation baffle."

INSULATION DAMS. A flexible device used between rafters at the eave line of roof systems that holds loose fill insulation away from soffit ventilation areas and prevents blockage of natural ventilation flow.

INTEGRAL-FLANGE DUCT COLLAR FITTING. A type of duct collar fitting having a flange that is secured to and sealed to the cylinder or sleeve of the fitting. A function of this flange is to provide a surface which can be sealed to rigid ductboard.

INTEGRATED PART-LOAD VALUE (IPLV). A single-number figure of merit based on part-load EER, COP, or kW/ton expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment.

INTERIOR LIGHTING POWER ALLOWANCE (ILPA). See "Lighting power allowance."

ISOLATION DEVICES. Devices that isolate HVAC zones so that they can be operated independently of one another. Isolation devices include, but are not limited to, separate systems, isolation dampers, and controls providing shutoff at terminal boxes.

JOIST, STEEL. Any structural steel member of a building or structure made of hot-rolled or cold-rolled solid or open-web sections.

KILOVOLT-AMPERE (kVA). Where the term "kilovoltampere" (kVA) is used in this standard, it is the product of the line current (amperes) times the nominal system voltage (kilovolts) times 1.732 for three-phase currents. For single-phase applications, kVA is the product of the line current (amperes) times the nominal system voltage (kilovolts).

KILOWATT (kW). The basic unit of electric power, equal to 1000 W.

KNEE WALLS. Vertical walls which separate conditioned space from the attic.

LABELED. Devices, appliances, assemblies or materials included in a list published by an approved testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment, appliances, assemblies or material, and whose listing states either that the equipment, appliances, assemblies, or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

LAMP. A generic term for a man-made light source often called a bulb or tube.

(a) **Compact fluorescent lamp:** A fluorescent lamp of a small compact shape, with a single base that provides the entire mechanical support function.

(b) **Fluorescent lamp:** A low-pressure electric discharge lamp in which a phosphor coating transforms some of the ultraviolet energy generated by the discharge into light.

(c) **General service lamp:** A class of incandescent lamps that provide light in virtually all directions. General service lamps are typically characterized by bulb shapes such as A, standard; S, straight side; F, flame; G, globe; and PS, pear straight.

(d) **High-intensity discharge (HID) lamp:** An electric discharge lamp in that light is produced when an electric arc is discharged through a vaporized metal such as mercury or sodium. Some HID lamps may also have a phosphor coating that contributes to the light produced or enhances the light color.

(e) **Incandescent lamp:** A lamp in which light is produced by a filament heated to incandescence by an electric current.

(f) **Reflector lamp:** A class of incandescent lamps that have an internal reflector to direct the light. Reflector lamps are typically characterized by reflective characteristics such as R, reflector; ER, ellipsoidal reflector; PAR, parabolic aluminized reflector; MR, mirrorized reflector; and others.

LIGHTING, DECORATIVE. Lighting that is purely ornamental and installed for aesthetic effect. Decorative lighting shall not include general lighting.

LIGHTING, GENERAL. Lighting that provides a substantially uniform level of illumination throughout an area. General lighting shall not include decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

LIGHTING SYSTEM. A group of luminaires circuited or controlled to perform a specific function.

LIGHTING POWER ALLOWANCE.

(a) Interior lighting power allowance: The maximum lighting power in watts allowed for the interior of a building.

(b) Exterior lighting power allowance: The maximum lighting power in watts allowed for the exterior of a building.

LIGHTING POWER DENSITY (LPD). The maximum lighting power per unit area of a building classification of space function.

LISTED. Equipment, materials or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material or service meets identified standards or has been tested and found suitable for a specified purpose.

LOW-RISE RESIDENTIAL. Single-family houses, multiple-family structures of three stories or fewer above grade, manufactured houses (mobile homes), and manufactured houses (modular).

LUMINAIRE. A complete lighting unit consisting of a lamp or lamps together with the housing designed to distribute the light, position and protect the lamps, and connect the lamps to the power supply.

MANUAL (NONAUTOMATIC). Requiring personal intervention for control. Nonautomatic does not necessarily imply a manual controller, only that personal intervention is necessary (see "Automatic").

MANUFACTURED BUILDING. A closed structure, building assembly, or system of subassemblies, which may include structural, electrical, plumbing, heating, ventilating, or other service systems manufactured for installation or erection, with or without other specified components, as a finished building or as part of a finished building, which shall include, but not be limited to, residential, commercial, institutional, storage, and industrial structures.

MANUFACTURED HOME. As defined by the U.S. Department of Housing and Urban Development, residential units constructed in accordance with Federal Mobile Construction and Safety Standards, pursuant to 42 USC 55.5401, et. seq. and 24 CFR 3282 and 3283.

MANUFACTURER. The company engaged in the original production and assembly of products or equipment or a company that purchases such products and equipment manufactured in accordance with company specifications.

MASS FLOOR. See "Floor."

MASS WALL. See "Wall."

MASTIC. A thick, pliable substance that adheres well to specific materials and is used for sealing different building components together. Mastics are often used in conjunction with fibrous or mesh fabric.

MASTIC RIBBONS. Malleable, putty-like packings which are used in applications akin to those of gasketing; but, they do not have elasticity of gasketing. Such mastics contain nearly 100 percent solids, require no curing in air, and are used without reinforcing fabric.

MEAN TEMPERATURE. One-half the sum of the minimum daily temperature and maximum daily temperature.

MECHANICAL CLOSET. For the purposes of this code, a closet used as an air plenum which contains the blower unit or air handler of a central air conditioning or heating unit.

MECHANICAL EQUIPMENT PLENUM CHAMBER. In an air-distribution system, that part of the casing, or an air chamber furnace, to or from which the air duct system delivers conditioned air.

MECHANICAL HEATING. Raising the temperature of a gas or liquid by use of fossil fuel burners, electric resistance heaters, heat pumps, or other systems that require energy to operate.

MECHANICAL COOLING. Reducing the temperature of a gas or liquid by using vapor compression, absorption,

desiccant dehumidification combined with evaporative cooling, or another energy-driven thermodynamic cycle. Indirect or direct evaporative cooling alone is not considered mechanical cooling.

MECHANICAL VENTILATION. The process of supplying or removing air by mechanical means to or from any space.

METAL BUILDING. A complete integrated set of mutually dependent components and assemblies that form a building, which consists of a steel-framed superstructure and metal skin.

METAL BUILDING ROOF. See "Roof."

METAL BUILDING WALL. See "Wall."

METERING. Instruments that measure electric voltage, current, power, etc.

MOTOR POWER, RATED. The rated output power from the motor.

MULTIPLE-FAMILY RESIDENCE. Any residential dwelling unit that is attached to another such unit by a common wall, ceiling or floor such as a duplex, townhouse, condominium or similar unit, regardless of ownership.

MULTIZONE SYSTEM(S). One or more HVAC system(s) designed to supply conditioned air to more than one independently serviced area of a building. Each zone must have separate thermostats and be separated by walls or closable doors not exceeding 40 square feet (4 m^2) between zones.

NAMEPLATE RATING. The design load operating conditions of a device as shown by the manufacturer on the nameplate or otherwise marked on the device.

NEW ENERGY. Energy, other than recovered energy, used for the purpose of heating or cooling (See "Energy").

NONAUTOMATIC. See "Manual."

NONDEPLETABLE ENERGY SOURCES. Sources of energy derived from incoming solar radiation, including photosynthetic processes, wind, waves, and tides, lake or pond thermal differences and energy derived from the internal heat of the earth, including nocturnal thermal exchanges.

NONRECIRCULATING SYSTEM. A domestic or service hot water distribution system that is not a recirculating system.

NONRENEWABLE ENERGY. Energy derived from a fossil fuel source.

NONRESIDENTIAL. All occupancies other than residential (see "Residential").

NONSTANDARD PART LOAD VALUE (NPLV). A single number part-load efficiency figure of merit calculated and referenced to conditions other than IPLV conditions, for units that are not designed to operate at ARI Standard Rating Conditions.

NONSWINGING DOOR. See "Door."

NORTH ORIENTED. Facing within 45 degrees of true north (northern hemisphere).

OCCUPANCY. The purpose for which a building, or part thereof, is used or intended to be used. For the purposes of determining changes of occupancy for this code, the occupancy shall be considered the major occupancy group designations established by the locally adopted building code.

OCCUPANT SENSOR. A device that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

OPAQUE. All areas in the building envelope, except fenestration and building service openings such as vents and grilles (see "Building envelope" and "Fenestration").

OPERABLE APERTURE AREAS. Areas of windows, sliding glass doors and screened entry doors that provide access to incoming breezes in their fully extended open position.

OPTIMUM START CONTROLS. Controls that are designed to automatically adjust the start time of an HVAC system each day with the intention of bringing the space to desired occupied temperature levels immediately before scheduled occupancy.

ORIENTATION. The direction an envelope element faces, i.e., the direction of a vector perpendicular to and pointing away from the surface outside of the element. For vertical fenestration, the two categories are north oriented and all other (see "North oriented").

OUTDOOR. The environment exterior to the building structure.

OUTDOOR (OUTSIDE) AIR. Air that is outside the building envelope or is taken from outside the building that has not been previously circulated through the building.

OUTSIDE. The environment exterior to the conditioned space of the building and may include attics, garages, crawlspaces, etc., but not return air plenums.

OVERCURRENT. Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit or ground fault.

OVERHANG HEIGHT. The vertical measure of the distance from the bottom of a window to the bottom of the overhang.

OVERHANG LENGTH. The horizontal measure of how far a window overhang projects out from the glass surface.

OVERHANG SEPARATION. The vertical measure of the distance from the top of a window frame to the bottom of an overhang.

PACKAGED TERMINAL AIR CONDITIONER (PTAC). A factory selected wall sleeve and separate unencased combination of heating and cooling components, assemblies or sections. It may include heating capability by hot water, steam, or electricity and is intended for mounting through the wall to serve a single room or zone.

PACKAGED TERMINAL HEAT PUMP (PTHP). A PTAC capable of using the refrigerating system in a reverse cycle or heat pump mode to provide heat.

PARTY WALL. A fire wall on an interior lot line used or adapted for joint service between two buildings.

PERMANENTLY INSTALLED. Equipment that is fixed in place and is not portable or movable.

PLENUM. A compartment or chamber to which one or more ducts are connected, that forms a part of the air distribution system, and that is not used for occupancy or storage. A plenum often is formed in part or in total by portions of the building.

POOL. Any structure, basin, or tank containing an artificial body of water for swimming, diving, or recreational bathing. The term includes, but is not limited to, swimming pool, whirlpool, spa, or hot tub.

POOL COVER. Sheet of material, typically plastic, designed to cover the water which may prevent water or heat loss through convection, radiation and evaporation.

POSITIVE INDOOR PRESSURE. A positive pressure condition within a conditioned space caused by bringing in more outside air than the amount of air that is exhausted and/or lost through air leakage.

POST OR PIER CONSTRUCTION. Raised wood floor supported above grade on posts or piers with unenclosed space beneath.

POWER. In connection with machines, power is the time rate of doing work. In connection with the transmission of energy of all types, power refers to the rate at which energy is transmitted. It is measured in watts (W) or British thermal units per hour (Btu/h). See "Horsepower".

PRESSURE ENVELOPE. The primary air barrier of a building; that part of the envelope that provides the greatest resistance to air flow to or from the building.

PRESSURE-SENSITIVE TAPE. Tape used for sealing duct system components and air barriers which adheres when pressure is applied and is not heat activated.

PRIMARY AIR SYSTEM. The central air-moving heating and cooling equipment that serves multiple zones through mixing boxes, VAV boxes, or reheat coils.

PRIMARY LIVING AREA. A family room or great room, or a living room if no family room or great room is present. Formal living rooms, where a family room or great room is present, dining rooms and kitchens are not considered primary living areas.

PROCESS ENERGY. Energy consumed in support of a manufacturing, industrial, or commercial process other than conditioning spaces and maintaining comfort and amenities for the occupants of a building.

PROCESS LOAD. The load on a building resulting from the consumption or release of process energy.

PROJECTION FACTOR (PF). The ratio of the horizontal depth of the external shading projection divided by the sum of the height of the fenestration and the distance from the top of the fenestration to the bottom of the farthest point of the external shading projection, in consistent units.

PROPOSED DESIGN. A computer representation of the actual proposed building design or portion thereof used as the basis for calculating the design energy cost.

PUBLIC FACILITY RESTROOM. A restroom used by the transient public.

PUMP SYSTEM ENERGY DEMAND (PUMP SYSTEM POWER). The sum of the nominal power demand (nameplate horsepower) of motors of all pumps that are required to operate at design conditions to supply fluid from the heating or cooling source to all heat transfer devices (e.g., coils, heat exchanger) and return it to the source.

RADIANT BARRIER SYSTEM (RBS). A building construction consisting of a low emittance (normally 0.1 or less) surface (usually aluminum foil) bounded by an open air space. A RBS is used for the sole purpose of limiting heat transfer by radiation and is not specifically intended to reduce heat transfer by convection or conduction.

RADIANT HEATING SYSTEM. A heating system that transfers heat to objects and surfaces within the heated space primarily (greater than 50 percent) by infrared radiation.

RATED LAMP WATTAGE. See "Lamp wattage, rated."

RATED MOTOR POWER. See "Motor power rated."

RATED *R*-VALUE OF INSULATION. The thermal resistance of the insulation alone as specified by the manufacturer in units of $h \cdot ft^2 \cdot °F/Btu$ at a mean temperature of 75°F (24°C). Rated *R*-value refers to the thermal resistance of the added insulation in framing cavities or insulated sheathing only and does not include the thermal resistance of other building materials or air films (see "Thermal resistance").

READILY ACCESSIBLE. Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc. In public facilities, accessibility may be limited to certified personnel through locking covers or by placing equipment in locked rooms.

RECIRCULATING SYSTEM. A domestic or service hot water distribution system that includes a closed circulation circuit designed to maintain usage temperatures in hot water pipes near terminal devices (e.g., lavatory faucets, shower heads) in order to reduce the time required to obtain hot water when the terminal device valve is opened. The motive force for circulation is either natural (due to water density variations with temperature) or mechanical (recirculation pump).

RECOOLING. Lowering the temperature of air that has been previously heated by a mechanical heating system.

RECORD DRAWINGS. Drawings that record the conditions of the project as constructed. These include any refinements of the construction or bid documents.

RECOVERED ENERGY. Energy utilized which would otherwise be wasted from an energy utilization system.

REFLECTANCE. The ratio of the light reflected by a surface to the light incident upon it.

REHEAT. The application of sensible heat to supply air that has been previously cooled below the temperature of the conditioned space by either mechanical refrigeration or the introduction of outdoor air to provide space cooling.

REHEATING. Raising the temperature of air that has been previously cooled either by mechanical refrigeration or an economizer system.

RENOVATION. Any structural repair, reconstruction or restoration to a structure, the costs of which equals or exceeds, over a one-year period, a cumulative total of 30 percent of the assessed value of the structure when that value is assessed, either:

1. Before the improvement or repair is started; or

2. Before the damage occurred, if the structure has been damaged.

For the purposes of this code, renovation occurs when the first alteration of any wall, ceiling, floor, or other structural part or mechanical system of the building commences, whether or not that alteration affects the external dimensions of the structure.

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

REPLACEMENT. The installation of part or all of an existing mechanical or electrical system in an existing building.

RESET. Automatic adjustment of the controller set point to a higher or lower value.

RESISTANCE, ELECTRIC. The property of an electric circuit or of any object used as part of an electric circuit that determines for a given circuit the rate at which electric energy is converted into heat or radiant energy and that has a value such that the product of the resistance and the square of the current gives the rate of conversion of energy.

RESIDENTIAL. (Subchapter 13-4 applications only.) Spaces in buildings used primarily for living and sleeping. Residential spaces include, but are not limited to, dwelling units, hotel/motel guest rooms, dormitories, nursing homes, patient rooms in hospitals, lodging houses, fraternity/sorority houses, hostels, prisons and fire stations.

RETROFIT. Modification of existing equipment or systems to incorporate improved performance of operation.

ROOF. The upper portion of the building envelope, including opaque areas and fenestration, that is horizontal or tilted at an angle of less than 60 degrees from horizontal. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Attic and other roofs:** All other roofs, including roofs with insulation entirely below (inside of) the roof structure (i.e., attics, cathedral ceilings, and single-rafter ceilings), roofs with insulation both above and below the roof structure, and roofs without insulation but excluding metal building roofs.

(b) **Metal building roof:** a roof that is constructed with (a) a metal, structural, weathering surface, (b) has no ventilated cavity, and (c) has the insulation entirely below deck (i.e., does not include composite concrete and metal deck construction nor a roof framing system that is separated from the superstructure by a wood substrate) and whose structure consists of one or more of the following configurations: (1) metal roofing in direct contact with the steel framing members; (2) insulation between the metal roofing and the steel framing members; or (3) insulated metal roofing panels installed as described in (1) or (2).

(c) **Roof with insulation entirely above deck:** A roof with all insulation (1) installed above (outside of) the roof structure and (2) continuous (i.e., uninterrupted by framing members).

(d) **Single-rafter roof:** A subcategory of attic roofs where the roof above and the ceiling below are both attached to the same wood rafter and where insulation is located in the space between these wood rafters.

ROOF AREA, GROSS. The area of the roof measured from the exterior faces of walls or from the centerline of party walls (see "Roof;" "Wall").

ROOF ASSEMBLY. All components of the roof/ceiling envelope through which heat flows, thereby creating building heat loss or gain, where such assembly is exposed to outdoor air and encloses a conditioned space. The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights exposed to the conditioned space.

ROOM AIR CONDITIONER. An encased assembly designed as a unit to be mounted in a window or through a wall, or as a console. It is designed primarily to provide direct delivery of conditioned air to an enclosed space, room, or zone. It includes a prime source of refrigeration for cooling and dehumidification and a means for circulating and cleaning air. It may also include a means for ventilating and heating.

ROOM CAVITY RATIO (RCR). A factor that characterizes room configuration as a ratio between the walls and ceiling and is based upon room dimensions.

SEAL or SEALING–AIR DUCT. The use of closure products either welds, mastic, mastic plus embedded fabric, adhesives, caulking, gaskets, pressure sensitive tapes, heat-activated tapes or combinations thereof as allowed by specific sections of this code, to close cracks, joints, seams, and other openings in the air barriers of air duct, air handling units, and plenum chambers for the purpose of preventing air leakage. No joint or opening from which a closure product is absent shall be considered sealed unless considered otherwise in specific cases identified by this code. Closeness of fit between mated parts alone shall not be considered a seal.

SEASONAL COEFFICIENT OF PERFORMANCE – COOLING (SCOPC). The total cooling output of an air conditioner during its normal annual usage period for cooling divided by the total electric energy input during the same period in consistent units (analogous to the SEER but for IP or other consistent units).

SEASONAL COEFFICIENT OF PERFORMANCE – HEATING (SCOPH). The total heating output of a heat pump during its normal annual usage period for heating divided by the total electric energy input during the same period in consistent units (analogous to the HSPF but for IP or other consistent units).

SEASONAL ENERGY EFFICIENCY RATIO (SEER). The total cooling output of an air conditioner during its normal annual usage period for cooling (in Btu) divided by the total electric energy input during the same period (in Wh).

SEMIEXTERIOR BUILDING ENVELOPE. See "Building envelope."

SEMIHEATED FLOOR AREA. See "Floor area."

SEMIHEATED SPACE. See "Space."

SEQUENCE. A consecutive series of common events.

SERVICE. The equipment for delivering energy from the supply or distribution system to the premises served.

SERVICE AGENCY. Agency capable of providing calibration, testing, or manufacture of equipment, instrumentation, metering, or control apparatus, such as a contractor, laboratory, or manufacturer.

SERVICE EQUIPMENT. The necessary equipment, usually consisting of a circuit breaker or switch and fuses and accessories, located near the point of entrance of supply conductors to a building or other structure (or an otherwise defined area) and intended to constitute the main control and means of cutoff of the supply. Service equipment may consist of circuit breakers or fused switches provided to disconnect all undergrounded conductors in a building or other structure from the service-entrance conductors.

SERVICE WATER HEATING. Heating water for domestic or commercial purposes other than space heating and process requirements.

SETBACK. Reduction of heating (by reducing the set point) or cooling (by increasing the set point) during hours when a building is unoccupied or during periods when lesser demand is acceptable.

SET POINT. Point at which the desired temperature (°F) of the heated or cooled space is set.

SHADING COEFFICIENT (SC). The ratio of solar heat gain at normal incidence through glazing to that occurring through $^1/_8$-inch (3.2 mm) thick clear, double-strength glass. Shading coefficient, as used herein, does not include interior, exterior, or integral shading devices.

SHELL BUILDING. A commercial building that is permitted prior to design completion or which will be finished in sections at a time after construction of the shell.

SIMULATION PROGRAM. A computer program that is capable of simulating the energy performance of building systems.

SINGLE-LINE DIAGRAM. A simplified schematic drawing that shows the connection between two or more items. Common multiple connections are shown as one line.

SINGLE-RAFTER ROOF. See "Roof."

SINGLE-ZONE SYSTEM. An HVAC system serving a single HVAC zone.

SINGLE ASSEMBLY. A roof and ceiling structure that is constructed as one unit with no attic space in between.

SINGLE-FAMILY RESIDENCE. Detached residential building suited for tenancy by one family unit.

SITE-INSTALLED COMPONENTS AND FEATURES. Equipment, materials, measures, practices and features which are affixed to a new manufactured home at its first set-up that are not initially installed by the manufacturer.

SITE-RECOVERED ENERGY. Waste energy recovered at the building site that is used to offset consumption of purchased fuel or electrical energy supplies.

SITE-SOLAR ENERGY. Thermal, chemical, or electrical energy derived from direct conversion of incident solar radiation at the building site and used to offset consumption of purchased fuel or electrical energy supplies. For the purposes of applying this standard, site-solar energy shall not include passive heat gain through fenestration systems.

SKYLIGHT. See "Fenestration."

SKYLIGHT WELL. The shaft from the skylight to the ceiling.

SLAB-ON-GRADE FLOOR. That portion of a slab floor of the building envelope that is in contact with the ground and that is either above grade or is less than or equal to 24 inches (610 mm) below the final elevation of the nearest exterior grade.

(a) **Heated slab-on-grade floor:** A slab-on-grade floor with a heating source either within or below it.

(b) **Unheated slab-on-grade floor:** A slab-on-grade floor that is not a heated slab-on-grade floor.

SOLAR ENERGY SOURCE. Source of thermal, chemical, or electrical energy derived from direct conversion of incident solar radiation at the building site.

SOLAR ENERGY SYSTEM. A complete set of coordinated components, which may be comprised of collectors, piping, pumps, heat exchangers, photovoltaic (PV) arrays, wiring, controls, power converters, and applicable storage, the design of which is intended to convert and utilize incident solar radiation to either heat water for hot water or space conditioning needs or to produce photovoltaic (PV) power for electrical needs.

SOLAR FRACTION (SF). Reserved.

SOLAR HEAT GAIN COEFFICIENT (SHGC). The ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space (see "Fenestration area").

SPACE. An enclosed space within a building. The classifications of spaces are as follows for the purpose of determining building envelope requirements.

(a) **Conditioned space:** A cooled space, heated space, or indirectly conditioned space defined as follows.

(1) Cooled space: an enclosed space within a building that is cooled by a cooling system whose sensible output capacity exceeds 5 Btu/h·ft^2 of floor area.

(2) Heated space: an enclosed space within a building that is heated by a heating system whose output capacity relative to the floor area is greater than or equal to 5 Btu/h·ft^2.

(3) Indirectly conditioned space: an enclosed space within a building that is not a heated space or a cooled space, which is heated or cooled indirectly by being connected to adjacent space(s) provided (a) the product of the *U*-factor(s) and surface area(s) of the space adjacent to connected space(s) exceeds the combined sum of the product of the *U*-factor(s) and surface area(s) of the space adjoining the outdoors, unconditioned spaces, and to or from semiheated spaces (e.g., corridors) or (b) that air from heated or cooled spaces is intentionally transferred (naturally or mechanically) into the space at a rate exceeding three air changes per hour (ACH) (e.g., atria).

(b) **Semiheated space:** An enclosed space within a building that is heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h·ft^2 of floor area but is not a conditioned space.

(c) **Unconditioned space:** An enclosed space within a building that is not a conditioned space or a semiheated space. Crawl spaces, attics, and parking garages with natural or mechanical ventilation are not considered enclosed spaces.

SPACE-CONDITIONING CATEGORY. (Subchapter 4 applications only). (1) Nonresidential conditioned space, (2) residential conditioned space and (3) nonresidential and residential semiheated space (see "Nonresidential," "Residential" and "Space").

SPACE CONSTRAINED PRODUCT. A central air conditioner or heat pump:

1. that has rated cooling capabilities no greater than 30,000 BTU/h;
2. that has an outdoor or indoor unit having at least two overall exterior dimensions or an overall displacement that
   (a) is substantially smaller than those of other units that are either currently usually installed in site-built single-family homes, and of a similar cooling and, if heat pump, heating capacity; and
   (b) if increased, would certainly result in a considerable increase in the usual cost of installation or would certainly result in a significant loss in the utility of the product to the consumer; and
3. is of a product type that was available for purchase in the United States as of December 1, 2000.

SPACE PERMITTING – INSULATION. Where an enclosed space exists in which insulation can be placed without the creation of space for that purpose only; e.g. dropped ceiling below a floor deck or space between joists.

SPACE TYPE. Descriptor of the visual activity to take place in a space; space types are those used for the FLA/COM calculation.

SPLIT SYSTEM. Air-conditioning system or heat pump with compressor and air handler in separate cabinets with the compressor typically located exterior to conditioned space.

STACK LOSSES. Unused heat energy escaping through a flue or chimney to the outdoors in a combustion heating system.

STEADY-STATE CONDITIONS (for gas- or oil-fired heating equipment). Equilibrium conditions as indicated by temperature variations of not more than 3°F (1.7°C) in the stack gas temperature for units equipped with integral draft diverters, or not more than 5°F (2.8°C) in flue gas temperature for units equipped with draft hoods, barometric draft regulators, or direct vent systems, in three successive temperature readings taken 15 minutes apart.

STEEL-FRAMED WALL. See "Wall."

STEEL-JOIST FLOOR. See "Floor."

STEM WALL CONSTRUCTION. A type of raised floor system consisting of a wood floor supported above grade by a continuous stem wall around its perimeter.

STORY. Portion of a building that is between one finished floor level and the next higher finished floor level or the roof, provided, however, that a basement or cellar shall not be considered a story

STRUCTURE. That which is built or constructed.

SUBSTANTIAL CONTACT. A condition where adjacent building materials are placed so that proximal surfaces are contiguous, being installed and supported so they eliminate voids between materials without compressing or degrading the thermal performance of either product.

SUN SPACE. A totally enclosed, unconditioned space which is built substantially of glass, attached to the conditioned space of the building, and designed primarily for winter space heating.

SUPPLEMENTARY HEAT. Heat provided, generally electric resistance heat, to make up the difference between heat provided by the refrigeration cycle of a heat pump and that required to meet the heating load at low temperatures. Supplementary heat shall not be construed as the heat required to provide 100-percent backup in case of system failure.

SWINGING DOOR. See "Door."

SYSTEM. A combination of equipment and auxiliary devices (e.g., controls, accessories, interconnecting means, and terminal elements) by which energy is transformed so it performs a specific function, such as HVAC, service water heating or lighting.

SYSTEM, EXISTING. A system or systems previously installed in an existing building.

TANDEM WIRING. Pairs of luminaires operating with lamps in each luminaire powered from a single ballast contained in one of the luminaires.

TASK LIGHTING. Lighting designed to provide illumination over a relatively small task area without providing significant general surrounding lighting.

TERMINAL. A device by which energy from a system is finally delivered, e.g., registers, diffusers, lighting fixtures, faucets, etc.

THERMAL BLOCK. A collection of one or more HVAC zones grouped together for simulation purposes. Spaces need not be contiguous to be combined within a single thermal block.

THERMAL CONDUCTANCE. See "C-factor."

THERMAL EFFICIENCY. For the purposes of this code, Thermal Efficiency shall be defined as included in the American National Standard Institute, Inc. standard ANSI Z 21.10.3-2001.

THERMAL RESISTANCE (R-VALUE). The reciprocal of the time rate of heat flow through a unit area induced by a unit temperature difference between two defined surfaces of material or construction under steady-state conditions. Units of R are h·ft^2·°F/Btu.

THERMAL ENVELOPE. The primary insulation layer of a building; that part of the envelope that provides the greatest resistance to heat flow to or from the building.

THERMAL MASS. Materials with mass heat capacity and surface area capable of affecting building loads by storing and releasing heat as the interior and/or exterior temperature and radiant conditions fluctuate. See "Wall heat capacity".

THERMAL MASS WALL INSULATION POSITION

1. **Exterior insulation position:** A wall having all or nearly all of its mass exposed to the room air with the insulation on the exterior of that mass.
2. **Integral insulation position:** A wall having mass exposed to both room and outside air with substantially equal amounts of mass on the inside and outside of the insulation layer.
3. **Interior insulation position:** A wall not meeting either of the above definitions, particularly a wall having most of its mass external to an insulation layer.

THERMOSTAT. An automatic control device used to maintain temperature at a fixed or adjustable set point.

THERMOSTATIC CONTROL. An automatic control device or system used to maintain temperature at a fixed or adjustable set point.

THROUGH-THE-WALL AIR CONDITIONER and HEAT PUMP. A central air conditioner or heat pump that is designed to be installed totally or partially within a fixed-size opening in an exterior wall; and

1. Is manufactured prior to January 23, 2010;
2. Is not weatherized;
3. Is clearly and permanently marked for installation-only through an exterior wall;
4. Has a rated cooling capacity no greater than 30,000 BTU/h;
5. Exchanges all of its outdoor air across a single surface of the equipment cabinet, and;
6. Has a combined outdoor air exchange area of less than 800 square inches (0.516 m^2) (split systems) or less than 1,210 square inches (0.780 m^2) (single packaged systems) as measured on the surface described in 5 above.

TINTED. As applied to fenestration: bronze, green, blue, or gray coloring that is integral with the glazing material. Tinting does not include surface applied films such as reflective coatings, applied either in the field or during the manufacturing process.

TOWNHOUSE. A single-family dwelling unit constructed in a series or group of attached units with property lines separating such units. For the purpose of this code, townhouses shall be considered multiple-family dwellings.

TRANSFER GRILLE. A louvered or perforated covering for an opening in an air passage through a wall or door allowing transport of return air from a separated conditioned space of a building to the space containing the air distribution system's primary return.

TRANSFORMER. A piece of electrical equipment used to convert electric power from one voltage to another voltage.

(a) **Dry-type transformer:** A transformer in which the core and coils are in a gaseous or dry compound.

(b) **Liquid-immersed transformer:** A transformer in which the core and coils are immersed in an insulating liquid.

***U*-FACTOR (THERMAL TRANSMITTANCE).** Heat transmission in unit time through unit area of a material or construction and the boundary air films, induced by unit temperature difference between the environments on each side. Units of U are Btu/h·ft^2·°F.

UNCONDITIONED SPACE. See "Space."

UNDER ATTIC. Location of ceiling area in residential occupancies where the roof assembly and ceiling assembly are separated by a continuous ventilated unconditioned space spanning the ceiling area. Scissors truss structures are considered under attic where a ventilated air space is provided.

UNENCLOSED SPACE. A space that is not an enclosed space.

UNIT ENERGY COSTS. Costs for units of energy or power purchased at the building site. These costs may include energy costs as well as costs for power demand as determined by the adopting authority.

UNITARY COOLING EQUIPMENT. One or more factory-made assemblies that normally include an evaporator or cooling coil and a compressor and condenser combination. Units that perform a heating function are also included.

UNITARY HEAT PUMP. One or more factory-made assemblies that normally include an indoor conditioning coil, compressor(s), and an outdoor refrigerant-to-air coil or refrigerant-to-water heat exchanger. These units provide both heating and cooling functions.

VARIABLE AIR VOLUME (VAV) SYSTEM. HVAC system that controls the dry-bulb temperature within a space by varying the volumetric flow of heated or cooled supply air to the space.

VENT DAMPER. A device intended for installation in the venting system of an individual, automatically operated, fossil fuel-fired appliance in the outlet or downstream of the appliance draft control device, which is designed to automatically open the venting system when the appliance is in operation and to automatically close off the venting system when the appliance is in a standby or shutdown condition.

VENTILATION. The process of supplying or removing air by natural or mechanical means to or from any space. Such air is not required to have been conditioned.

VENTILATION AIR. That portion of supply air which comes from outdoors, plus any cleaned recirculated air to maintain the desired quality of air within a designated space (see "Outdoor air").

VERTICAL FENESTRATION. See "Fenestration."

VISIBLE TRANSMITTANCE (VT). Transmittance of glazing material over the visible portion of solar spectrum.

VOLTAGE DROP. A decrease in voltage caused by losses in the lines connecting the power source to the load.

WALL. That portion of the building envelope, including opaque area and fenestration, that is vertical or tilted at an angle of 60 degress from horizontal or greater. This includes above

and below-grade walls, between floor spandrels, peripheral edges of floors, and foundation walls. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Above-grade wall:** A wall that is not a below-grade wall.

(b) **Below-grade wall:** That portion of a wall in the building envelope that is entirely below the finish grade and in contact with the ground.

(c) **Mass wall:** A wall with a heat capacity exceeding (1) 7 Btu/ft^2·°F or (2) 5 Btu/ft^2·°F provided that the wall has a material unit weight not greater than 120 lb/ft^3 (1922 kg/m^3).

(d) **Metal building wall:** A wall whose structure consists of metal spanning members supported by steel structural members (i.e., does not include spandrel glass or metal panels in curtain wall systems).

(e) **Steel-framed wall:** A wall with a cavity (insulated or otherwise) whose exterior surfaces are separated by steel framing members (i.e., typical steel stud walls and curtain wall systems).

(f) **Wood-framed and other walls:** All other wall types, including wood stud walls.

WALL AREA, GROSS. The area of the wall measured on the exterior face from the top of the floor to the bottom of the roof.

WARM-UP. Increase in space temperature to occupied set point after a period of shutdown or setback.

WATER HEATER. Vessel in which water is heated and is withdrawn for use external to the system.

WATT. The electrical unit of power or rate of doing work. One watt = 0.00134 h.p.

WHOLE-HOUSE FAN. A mechanical ventilation system usually installed in the ceiling of a residence which is used to exhaust air from the interior of a building to an attic space with sufficient venting area to transfer the air to the outside.

WING WALLS. An architectural projection which is designed to create positive pressure over one window and negative over another that redirects natural winds in through windows or doors.

WORST CASE. A unit of a residential structure with the same general layout and percent glass which generates the highest as-built points in a Method A, Subchapter 6 calculation procedure.

The worst case unit will have the largest amount of glass facing east and west (primary orientation) and south (secondary orientation).

ZONE, HVAC. A space or group of spaces within a building with heating and cooling requirements that are sufficiently similar so that desired conditions (e.g. temperature) can be maintained throughout using a single sensor (e.g. thermostat or temperature sensor).

SUBCHAPTER 13-3

REFERENCED STANDARDS AND ORGANIZATIONS

SECTION 13-301
REFERENCED STANDARDS

13-301.0 General. The standards (Std), and portions thereof, which are referred to in various parts of this code shall be part of Chapter 13 of the *Florida Building Code* and are hereby declared to be a part of this code. Section numbers shall read as if prefaced by 13-.

AABC

Associated Air Balance Council,
1518 K Street, Suite 503,
Washington, DC 20005

Standard reference number	Title	Referenced in code section number
AABC, 1989	Associated Air Balance Council National Standard	410.ABC.4.3

AAMA

American Architectural Manufacturers Association
1827 Walden Office Square, Suite 104
Schaumburg, IL 60173-4268

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S. 2-05	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	406.ABC.1.1, 606.ABC.1.1

ACCA

Air Conditioning Contractors of America
2800 Shirlington Road, Suite 300
Arlington, VA 22206

Standard reference number	Title	Referenced in code section number
ACCA Manual D-1995	Residential Duct Systems	410.ABC.2, 610.ABC.1
ACCA Manual J-2003	Residential Load Calculation, Eighth Edition with posted updates/errata	607.ABC.1
ACCA Manual N-2005	Commercial Load Calculation	607.ABC.1, B-3.1.1

ADC

Air Diffusion Council
1000 E. Woodfield Rd., Suite 102
Schaumburg, IL 60173-5921

Standard reference number	Title	Referenced in code section number
ADC 2003	Flexible Duct Performance & Installation Standards, Fourth Edition	410.ABC.2.2, 610.ABC.2.2

AHAM

Association of Home Appliance Manufacturers
20 North Wacker Dr.
Chicago, IL 60606

Standard reference number	Title	Referenced in code section number
ANSI/AHAM RAC1-03	Room Air Conditioners	Table 407.ABC.3.2D, Table 607.ABC.3.2D

AMCA

Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004-1806

Standard reference number	Title	Referenced in code section number
AMCA 500-1989	Test Methods for Louvers, Dampers, and Shutters	409.ABC.3.4

ANSI

American National Standards Institute, Inc.
25 West 43rd Street, Fourth Floor
New York, N.Y.10036.

Standard reference number	Title	Referenced in code section number
ANSI A112.18.1M-1999	Finished and Rough Brass Plumbing Fixture Fittings	412.ABC.2.5.1, 608.A.3.5, 612.ABC.2.4
ANSI Z21.10.3-2004	Gas Water Heater, Volume 3, Storage, with Input Ratings above 75,000 Btu/h, Circulating and Instantaneous Water Heaters	Table 412.ABC.3, 612.ABC.3.1.2
ANSI Z21.40.4-96 (with Addenda 1)	American National Standard for Performance Testing and Rating of Gas-Fired, Air-Conditioning and Heat Pump Appliances.	607.A.1, C-5.1.1
ANSI Z21.47a-04	Gas-Fired Central Furnaces	Table 408.ABC.3.2E, Table 608.ABC.3.2E
ANSI Z21.56-2006	Gas-Fired Pool Heaters	412.ABC.3.5, 612.ABC.2.3.1
ANSI Z21.66-1996 (R2001)	Automatic Vent Damper Devices for Use with Gas-Fired Appliances	408.ABC.3.2.1
ANSI Z83.8/CGA 2.6 -2006	Gas Unit Heaters and Gas-Fired Duct Furnaces	Table 408.ABC.3.2E, Table 608.ABC.3.2E

ARDM

Association of Refrigerant Desuperheater Manufacturers, Inc,
c/o Doucette Industries
4151 112 Terrace N
Clearwater, FL 33762

Standard reference number	Title	Referenced in code section number
ARDM-88	Residential Heat Recovery Installation Guide, First Edition	600.2.1, 2C6.2.1.1

ARI

Air-Conditioning and Refrigeration Institute
Suite 200
4100 North Fairfax Drive
Arlington, VA 22203

Standard reference number	Title	Referenced in code section number
210/240-2006	Unitary Air-Conditioning and Air-Source Heat Pump Equipment	Table 407.ABC.3.2A, Table 407.ABC.3.2B, Table 607.ABC.3.2A, Table 607.ABC.3.2B, 607.ABC.3.1, 608.ABC.3.1
310/380-2004	Packaged Terminal Air-Conditioners and Heat Pumps	Table 407.ABC.3.2D, Table 607.ABC.3.2D
340/360-2004	Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment	Table 407.ABC.3.2A, Table 407.ABC.3.2B, Table 607.ABC.3.2A, Table 607.ABC.3.2B
365-2002	Commercial and Industrial Unitary Air-Conditioning Condensing Units	Table 407.ABC.3.2A, Table 607.ABC.3.2A
390-2003	Single Packaged Vertical Air Conditioners and Heat Pumps	Table 410.ABC.3.2D, 610.ABC.3.2D
460-2005	Performance Rating of Remote Mechanical Draft Air-Cooled Refrigerant Condensers	Table 407.ABC.3.2G

550/590-2003	Water Chilling Packages Using the Vapor Compression Cycle	202, 407.ABC.3.2, Table 407.ABC.3.2C
560-2000	Absorption Water Chilling and Water Heating Packages	Table 407.ABC.3.2C
1160-2004	Performance Rating of Heat Pump Pool Heaters	Table 412.ABC.3, 612.ABC.2.3.4

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle, NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
ANSI/ASHRAE Std.55-1992	Thermal Environmental Conditions for Human Occupancy	412.ABC.1, 412.ABC.1
ANSI/ASHRAE Std. 62.1-2004	Ventilation for Acceptable Indoor Air Quality	407.ABC.2.1.1, 407.ABC.2.3, 409.ABC.1.1, 409.ABC.3.5, 609.ABC.1
ANSI/ASHRAE Std. 90.1-2004	Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings	413.0
ANSI/ASHRAE Std.93-1986 (RA91)	Methods of Testing to Determine the Thermal Performance of Solar Collectors	612.ABC.3.4
ANSI/ASHRAE 119-1988 (RA 94)	Air Leakage Performance for Detached Single-Family Residential Buildings	Table 13-613.A.1-1
ANSI/ASHRAE 124-1991	Methods of Testing for Rating Combination Space-Heating and Water-Heating Appliances	608.A.3.5, 612.A.1
ANSI/ASHRAE 137-1995 (RA2001)	Methods of Testing for Efficiency of Space-conditioning/Water-Heating Appliances That Include a Desuperheater Water Heater	412.ABC.1, 612.A.1
ANSI/ASHRAE 146-1998	Method of Testing for Rating Pool Heaters	Table 412.ABC.3
ANSI/ASHRAE 152-2004	Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems	610.A.2, Table 13-613A.1-1
ASHRAE Handbook	Fundamentals, 2005	Table 13-613A.1-1
ASHRAE Handbook	HVAC Applications, 2003	412.ABC.1, 412.ABC.2.1.1
ASHRAE Handbook	Fundamentals, 2005	202, B-3.1.1, B-3.1.2, B-3.13
ASHRAE Handbook	HVAC Systems & Equipment, 2004	410.ABC.3, 610.ABC.3
ASHRAE, 1998	Cooling and Heating Load Calculation Principles	607.ABC.1

ASTM

ASTM International
100 Barr Harbor Dr
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in code section number
ASTM C36/C36M-03	Standard Specification for Gypsum Wallboard	202
ASTM C90-06b	Standard Specification for Loadbearing Concrete Masonry Units	402.C.1, Appendix 13-B B-1.2.3, Appendix 13-B B-2.2.1.1
ASTM C 177-04	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus	410.ABC.2.3, 610.ABC.2.2, Appendix 13-B B-1.3.4
ASTM C272-01	Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions	B-1.3.4
ASTM C 335-05ae1	Test Method for Steady-State Heat Transfer Properties of Pipe Insulation	Table 411.ABC.2
ASTM C 516-02	Vermiculite Loose Fill Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 518-04	Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus	Appendix 13-C Table C1.2.3
ASTM C 549-06	Perlite Loose Fill Insulation	Appendix 13-C Table C1.2.3
ASTM C 578-06	Rigid, Cellular Polystyrene Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 665-06	Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing	Appendix 13-C Table C1.2.3
ASTM C 727-01	Standard Practice for Installation and Use of Reflective Insulation in Building Constructions	Appendix 13-C Table C1.2.3
ASTM C 735-05b	Cellulosic Fiber Loose-Fill Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 764-06a	Mineral Fiber Loose-Fill Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 1015-06	Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 1029-05a	Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 1158-05	Standard Practice for Use and Installation of Radiant Barrier Systems (RBS) in Building Construction	607.A.4, Appendix 13-C Table C1.2.3
ASTM C 1224-03	Reflective Insulation for Building Applications	607.A.3.2, Appendix 13-C Table C1.2.3

ASTM C 1289-06	Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board	Appendix 13-C Table C1.2.3
ASTM C 1313-05	Sheet Radiant Barriers for Building Construction Applications	607.A.3.2, Appendix 13-C Table C1.2.3
ASTM C 1320-05	Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light-Frame Construction	Appendix 13-C Table C1.2.3
ASTM C 1321-04	Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCC) in Building Construction	607.A.4
ASTM C 1363-05	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus	602.A.2, Appendix 13-B B-1.1.1, B-1.1.2
ASTM C 1371-04a	Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers	404.C.1, 607.A.4
ASTM C 1549-04	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflector	404.C.1, 604.A.4
ASTM E 84-06a	Test Method for Surface Burning Characteristics of Building Materials	410.ABC.3.0.7, 610.ABC.3.0.7
ASTM E 283-04	Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	406.ABC, 406.ABC.1.1, 606.ABC.1.1, 606.ABC.1.2.4, Appendix C C3.4.3
ASTM E 408-71 (2002)	Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques	404.C.1
ASTM E 903-96	Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres	404.C.1, 604.A.4, Appendix C 2C4.2.1.5
ASTM E 1918-06	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field	404.C.1, 604.A.4

CRRC

Cool Roof Rating Council
1738 Excelsior Avenue
Oakland, CA 94602

Standard reference number	Title	Referenced in code section number
CRRC-1-2006	CRRC-1 Product Rating Program	404.C.1, 604.A.4

CTI

Cooling Technology Tower Institute
2611 FM 1960 West, Suite H-200
Houston, TX 77068-3730.

Standard reference number	Title	Referenced in code section number
CTI ATC-105-2000	Acceptance Test Code for Water Cooling Towers	Table 407.ABC.3.2G
CTI Std. 201-2002	Certification Standard for Water Cooling Tower Thermal Performance	Table 407.ABC.3.2G

DASMA

Door and Access Systems Manufacturers Association
1300 Sumner Avenue
Cleveland, OH 44115-2851.

Standard reference number	Title	Referenced in code section number
ANSI/DASMA105-1992 (R1998)	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors	406.ABC.1.1

DOE

United States Department of Energy
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
DOE, 10 CFR, Part 430 Subpart B, App. E-1998	Uniform Test Method for Measuring the Energy Consumption of Water Heaters	Tables 408.ABC.3.2F, 608.ABC.3.2F, 412.ABC.3, 612.ABC.3.1.1, 612.ABC.3.2

Subpart B, App. M	Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners	607.ABC.3.1
10 CFR, Part 430 Subpart B, App N -1998	Uniform Test Method for Measuring the Energy Consumption of Furnaces	Tables 408.ABC.3.2E, 608.ABC.3.2E
DOE, 10 CFR, Part 430 Subpart B, App O-1998	Uniform Test for Measuring the Energy Consumption of Vented Home Heating Equipment	202
EPACT, 92 42 USC 6831, et seq Public Law 102-486	Energy Policy Act of 1992	407.ABC.3.2, 414.ABC.1, 607.ABC.3.2.1
NAECA, 1987	National Appliance Energy Conservation Act of 1987	Tables 407.ABC.3.2A, B; 408.ABC.2.2, Table 408.ABC.3.2E, 607.ABC.3.1, Tables 607.ABC.3.2A, B, 608.ABC.3.1

Florida Codes

Building Codes and Standards Office
Florida Department of Community Affairs
2555 Shumard Oak Blvd.
Tallahassee, Fl 32399-2100

Standard reference number	Title	Referenced in code section number
FL-1	Florida Standard for Desuperheater/Water Heaters (See Appendix E of this code)	612.B.3.2, 612.A.3.1

FSEC

Florida Solar Energy Center
1679 Clearlake Road
Cocoa, FL 32922-5703

Standard reference number	Title	Referenced in code section number
2007	EnergyGauge USA Fla/Res	600.2, 600.A.1, 600.A.2, 601.A, 601.A.3, 602.A.1, 604.A.1, 604.A.4, 605.A.1, 606.A.1, 607.A.1, 608.A.1, 610.A.1, 610.A.2, 612.A.1, 613.A.2.1
2007	EnergyGauge Summit Fla/Com	400.0.A, 400.0.C, 400.0.C.4, 400.2, 400.3.ABC.1, 400.3.ABC.2, 400.3.A, 400.3.B, Table 13-400.3.ABC.3, 401.A, 401.B, 402.A, 402.B, 403.A, 403.B, 404.ABC.1, 404.A, 404.B, 405.A, 405.B, 407.A, 408.A, 409.A, 412.A, 415.A, 415.B, 415.B.1
FSEC-RR-54-00	"The HERS Rating Method and the Derivation of the Normalized Modified Loads Method", October 11, 2000, Fairey, P., J. Tait, D. Goldstein, D. Tracey, M. Holtz, and R. Judkoff. Available online at: http://www2.fsec.ucf.edu/en/publications/html/FSEC-RR-54-00/index.htm	13-613.A.2.1

FTC

U.S. Federal Trade Commission
Sixth Street and Pennsylvania Avenue, N.W.
Washington, DC 20580

Standard reference number	Title	Referenced in code section number
FTC, 16 CFR, Part 460, Amended Effective 4/29/96	FTC Labeling and Advertising of Home Insulation	202, Appendix C C-1.2

GAMA

Gas Appliance Manufacturers Association
PO Box 9245
Arlington, VA 22209

Standard reference number	Title	Referenced in code section number
GAMA	Consumers' Directory of Certified Efficiency Ratings for Water Heating Equipment	Table 408.ABC.3.2F, Table 608.ABC.3.2F, 612.ABC.3.5, 612.A.1

HI

Hydronics Institute
P.O. Box 218
Berkeley Heights, NH 07922

Standard reference number	Title	Referenced in code section number
H.I., HBS 86-1989	Testing and Rating Standard for Heating Boilers	Tables 408.ABC.3.2F, 608.ABC.3.2F

HUD

U.S. Dept. Housing and Urban Development
451 7th Street S.W.
Washington, DC 20410

Standard reference number	Title	Referenced in code section number
HUD, 24 CFR 3282-3283	Manufactured Home Procedural and Enforcement Regulations	202
HUD, 42 CFR 70, s. 5401 (24 CFR 3280)	Manufactured Home Construction and Safety Standards	202
HUD, 42 USC 77, s. 6295	Energy Conservation Standards	202

ISO

International Standards Organization
1, rue de Varembe, Case postale 56,
CH-1211 Geneve 20, Switzerland

Standard reference number	Title	Referenced in code section number
ISO 9806 (1994, 1995)	Test Methods for Solar Collectors Part 1: Thermal Performance of glazed liquid heating collectors including pressure drop, December 1, 1994 Part 2: Qualification test procedures, August 15, 1995. Part 3: Thermal performance of unglazed liquid heating collectors (sensible heat transfer only) including pressure drop, December 15, 1995.	612.ABC.3.4
ISO 13256-1 (1998)	Water-Source Heat Pumps—Testing and Rating for Performance—Part 1 Water-to-Air and Brine-to-Air Heat Pumps	Table 407.ABC.3.2B, Table 607.ABC.3.2B

NAIMA

North American Insulation Manufacturers Association
44 Canal Center Plaza, Suite 310,
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
NAIMA 2002	Fibrous Glass Duct Construction Standards, Fifth Edition	410.ABC.3.2, 610.ABC.3.2
NAIMA 2002	Fibrous Glass Duct Liner Standard, Third edition	410.ABC2.5, 610.ABC.2.4, 610.ABC.3

NEBB

National Environmental Balancing Bureau
8575 Grovemont Circle
Gaithersburg, MD 20877-4121

Standard reference number	Title	Referenced in code section number
NEBB, 2005	Procedural Standards For Testing Adjusting Balancing of Environmental Systems, Seventh Edition	410.ABC.4.3

NEMA

National Electrical Manufacturers Association
1300 N 17th Street, Suite 1847
Rosslyn, VA 22209

Standard reference number	Title	Referenced in code section number
NEMA MG 1-2004	Motors and Generators	202

NFPA

National Fire Prevention Assoc.
Batterymarch Park
Quincy, MA 02269

Standard reference number	Title	Referenced in code section number
NFPA 96-2004	Ventilation Control and Fire Protection of Commercial Cooking Operations	407.ABC.3.5, 409.ABC.3.6.1

NFRC

National Fenestration Rating Council, Inc.
8484 Georgia Avenue, Suite 320
Silver Spring, MD 20910

Standard reference number	Title	Referenced in code section number
NFRC 100-2004	Procedure for Determining Fenestration Product *U*-factors	601.ABC.1, Appendix B B-2.1, B-2.3
NFRC 200-2004	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmitttance at Normal Incidence	401.AB.5, 601.ABC.1, 601.A.2
NFRC 300-2004	Standard Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems	Appendix B B-2.1
NFRC 400-2004	Procedure for Determining Fenestration Product *U*-factorsAir Leakage	406.ABC.1.1

SMACNA

Sheet Metal and Air-Conditioning Contractors' National Association, Inc.
4201 Lafayette Center Dr.
Chantilly, VA 20151-1209

Standard reference number	Title	Referenced in code section number
SMACNA, 1985	HVAC Air Duct Leakage Test Manual	410.ABC.3.1.3, 610.ABC.3, 610.ABC.3.1.3

SRCC

Solar Rating and Certification Corporation
c/o Florida Solar Energy Center
1679 Clearlake Road
Cocoa, FL 32922-5703

Standard reference number	Title	Referenced in code section number
FSEC	Directory of Certified Solar Systems	612.ABC.3.4, 612.B.3.3
SRCC TM-1	Solar Domestic Hot Water System and Component Test Protocol, December 6, 2002	612.ABC.3.4

UL

Underwriters Laboratory, Inc.
333 Pfingsten Rd.
Northbrook, Il. 60062-2096

Standard reference number	Title	Referenced in code section number
UL 181-05	Standard for Factory-Made Air Ducts and Air Connectors with revisions through December 1998	410.ABC.3.0.7, 410.ABC.3.7.1, 610.ABC.3, 610.ABC.3.0.7, 610.ABC.3.7.1
UL 181A-05	Closure Systems for Use With Rigid Air Ducts and Air Connectors, with revisions through December 1998	410.ABC.3.0.7,

		610.ABC.3, 610.ABC.3.0.7
UL 181B-05	Closure Systems for Use With Flexible Air Ducts and Air Connectors with revisions through May 2000.	410.ABC.3.0.7, 610.ABC.3, 610.ABC.3.0.7
UL 723-03	Standard for Test for Surface Burning Characteristics of Building Materials.	410.ABC.3.0.7, 610.ABC.3.0.7
UL 727-06	Standard for Oil-Fired Central Furnaces.	Table 408.ABC.3.2E,Table 608.ABC.3.2E
UL 731-95	Standard for Oil-Fired Unit Heaters, with revisions through January 1999.	Table 408.ABC.3.2E,Table 608.ABC.3.2E

WDMA

Window & Door Manufacturers Association
1400 East Touhy Avenue, #470
Des Plaines, IL 60018

Standard reference number	Title	Referenced in code section number
101/I.S.2/NAFS-02	Voluntary Performance Specifications for Windows, Skylights and Glass Doors	606.ABC.1.1

SUBCHAPTER 13-4

COMMERCIAL BUILDING COMPLIANCE METHODS

SECTION 13-400 ADMINISTRATION

13-400.0 Scope, Methods of compliance. The provisions of this chapter apply to all new commercial occupancy buildings, additions to existing commercial occupancy buildings, and multiple-family residential buildings over three stories in height. Building type classifications shall be those defined in Subchapter 13-2 of this code under "occupancy classification." This subchapter provides three methods by which commercial buildings may be brought into compliance with this code.

13-400.0.A Method A, the Whole Building Performance Method. This is a computer-based energy code budget method which may be used for determining the compliance of all proposed designs, except designs with no mechanical system. Under this method, cost performance is calculated for the entire building based on the envelope and major energy-consuming systems specified in the design and simultaneously for a baseline building of the same configuration, but with baseline systems. Compliance is met if the *design energy cost* does not exceed the *energy cost budget* when calculated in accordance with this section; and the energy efficiency level of components specified in the building design meet or exceed the efficiency levels used to calculate the *design energy cost*. Compliance calculations are those utilized in the EnergyGauge Summit–Fla/Com-2007 computer program and are as described in Appendix 13-B. Basic prescriptive requirements described in the sections called Mandatory Requirements shall also be met.

***Note*:** The *energy cost budget* and the *design energy cost* calculations are applicable only for determining compliance with this standard. They are not predictions of actual energy consumption or costs of the *proposed design* after construction. Actual experience will differ from these calculations due to variations such as occupancy, building operation and maintenance, weather, energy use not covered by this standard, changes in energy rates between design of the building and occupancy, and precision of the calculation tool.

13-400.0.B Method B, the Building Envelope Trade-off Method. This is a computer-based calculation methodology. The *building envelope* complies with the standard if the proposed building meets the Mandatory requirements (.ABC) and the *envelope performance factor* of the proposed building is less than or equal to the *envelope performance factor* of the budget building. The *envelope performance factor* considers only the *building envelope* components. Schedules of operation, lighting power, equipment power, occupant density and mechanical systems shall be the same for both the proposed building and the budget building. *Envelope performance factor* shall be calculated using the EnergyGauge Summit Fla/Com 2007 computer program and the procedures specified for each envelope component under compliance Method B.

13-400.0.C Method C, the Buildings Prescriptive Envelope Method. This method requires that prescriptive requirements listed on Form 400C for the building's location for a given building type be met or exceeded to comply with this code. For *conditioned space*, the exterior building envelope shall comply with either the "nonresidential" or "residential" requirements on Form 400C, as applicable. If a building contains any semiheated space or unconditioned space (see Section 400.0.C.1), then the *semi-exterior building envelope* shall comply with the requirements for *semiheated* space on Form 400C.

13-400.0.C.1 Scope. Method C may be used, provided that:

(a) The *vertical fenestration area* does not exceed 50 percent of the *gross wall area* for each *space-conditioning category* and

(b) The *skylight fenestration area* does not exceed 5 percent of the *gross roof area* for each *space-conditioning category*.

Requirements are specified for the exterior building envelope, which separates conditioned space from the exterior.

Exceptions: For buildings that contain spaces that will be only semiheated or unconditioned, and if compliance Method A is used for such spaces, then Method C also specifies requirements for the semiexterior building envelope, which separates:

(a) Conditioned space from either semiheated space or unconditioned space,

(b) Semiheated space from either unconditioned space or from the exterior.

NOTE: Method C does not address moisture control or provide design guidelines to prevent moisture migration that leads to condensation, mold and mildew, or deterioration to insulation or equipment performance.

13-400.0.C.2 Space conditioning. Envelope requirements are specified by space-conditioning categories. Separate *exterior building envelope* requirements are specified for each of two categories of conditioned space:

a. Nonresidential conditioned space,

b. Residential > three stories conditioned space.

Spaces shall be assumed to be *conditioned space* and shall comply with the requirements for *conditioned space* at the time of construction, regardless of whether mechanical or electrical equipment is included in the building permit application or installed at that time.

Exceptions: For buildings that contain *spaces without air conditioning* that will be only *semi-heated* or *unconditioned*, and if alternative compliance is sought for such spaces, then all *semi-heated* or *unconditioned* spaces shall be clearly indicated on the floor plan as such, and the following *semi-exterior building envelope* requirements apply:

1. If a *space* will be only *semi-heated*, the space shall be considered *semi-heated*
2. If a space will remain unconditioned, the space shall be considered unconditioned

13-400.0.C.3 Envelope requirements. Building envelope components shall meet the efficiencies shown on Form 400C for the building's location.

13-400.0.C.3.1 Insulation. Where insulation is utilized to meet a given building component on Form 400C, it shall comply with the requirements found in Appendix 13-B for that component.

13-400.0.C.3.2 Maximum *U*-factor, C-factor, F-factor. In lieu of complying with the minimum rated *R*-value of insulation for the insulation alone, compliance shall be shown with the maximum *U*-factor, C-factor or F-factor for the entire assembly for the component. *U*-factors, C-factors, and F-factors for typical construction shall be determined from Appendix 13-B or by the procedures established by Appendix 13-B.

13-400.0.C.4 Renovated buildings. Renovated buildings shall, when applicable (see Section 13-202), meet the efficiencies listed on Form 400C for components being changed or shall comply with the envelope or systems criteria in Method B of EnergyGauge Summit–Fla/Com for the components being changed. Existing buildings not meeting the definition of a renovation in which new heating, cooling, water heating, electrical or lighting systems are installed shall meet the Mandatory minimum efficiencies listed in this code for the system(s) being changed.

13-400.1 Types of requirements. Mandatory requirements shall be met for all buildings. The section number followed by the combined number and letters ".ABC" indicates these Mandatory Requirements (i.e., requirements that shall be met by buildings complying by either Method A, B, or C) in Sections 13-401 through 13-415. Requirements specific to Method A, B, or C (i.e. ".B" is specific to Method B) shall be met when complying with the code by that Method. Where a requirement specific to a method is more stringent than the Mandatory Requirement, the more stringent requirement shall be met.

13-400.2 Performance calculation procedures. The calculation procedures contained in the personal computer-based program entitled EnergyGauge Summit Fla/Com 2007 and those described in Appendix 13-B, shall be used to demonstrate code compliance of the design for commercial buildings complying by Method A, B or C of this chapter. The building components' efficiency levels specified in the Method A performance compliance calculation are the minimum efficiencies allowed to be installed in the building. Buildings complying by Method B are allowed performance tradeoffs for envelope features only. Buildings complying by Method C have only prescriptive minimum requirements for envelope and equipment.

13-400.2.A.1 Additions. Additions to existing buildings shall follow the same Method A calculation procedure as new construction with the following qualifications:

1. Calculations shall be conducted using only the components of the addition itself, including those preexisting components which separate the addition from other spaces.
2. Efficiencies for heating and cooling systems shall be assumed to be the minimum efficiency allowed by the code for that type and size of equipment unless new equipment is installed to replace existing equipment or to service the addition specifically or higher equipment efficiencies can be documented.

13-400.2.A.2 Shell buildings. Shell buildings shall comply with this code by Method B or Method C. Once all energy-related design parameters are known, a Method A calculation may be resubmitted.

13-400.3 Certification of compliance.

13-400.3.ABC.1 Code compliance preparation. The EnergyGauge Summit–Fla/Com-2007 performance calculation procedures demonstrating code compliance for Methods A and B, and Form 400C demonstrating code compliance for Method C shall be prepared, signed and sealed by an architect or engineer registered in the state of Florida, with the exception of buildings excluded by Section 481.229, *Florida Statutes*, or Section 471.003, *Florida Statutes*. Calculations for buildings falling within the exception of Section 471.003, *Florida Statutes,* may be performed by air conditioning or mechanical contractors licensed in accordance with Chapter 489, *Florida Statutes*, or by state of Florida certified commercial building energy raters.

The person preparing the compliance calculation shall certify that the calculation, or amendments thereto, is true and accurate and demonstrates that the building is in compliance with the requirements of Chapter 13 of this code.

13-400.3.ABC.2 Code compliance certification. The building's owner, the owner's architect, or other authorized agent legally designated by the owner shall certify to the building official that the building is in compliance with the requirements of Chapter 13 of this code prior to receiving the permit to begin construction or renovation.

If, during the building's construction or renovation, alterations are made in the building's design or in materials or equipment installed in the building which would diminish it's energy performance, an amended copy of the compliance certification shall be submitted to the building official on or before the date of final inspection

by the building owner or his or her legally authorized agent.

The certified EnergyGauge Summit Fla/Com calculation printout or Form 400C shall be a part of the plans and specifications submitted for permitting.

The party responsible under Subsections 471.003 and 481.228 and Chapter 489, *Florida Statutes*, for the design and specification of each building system shall certify that the plans and specifications for that system comply with the requirements of Chapter 13 of this code (see also Section 13-103.2).

13-400.3.ABC.3 Forms. Forms referenced in Table 13-400.3.ABC.3 shall be used to demonstrate code compliance with this chapter. Climate zones used in Subchapter 13-4 shall be as defined in Section 13-202 under ASHRAE Climate Zone.

13-400.3.A Method A Forms. An accurately completed Form 400A-07 (generated by the EnergyGauge Summit Fla/Com-2007 computer program) demonstrating that code compliance has been achieved shall be submitted to the building official for Method A compliance. Calculations shall be performed for the building's location.

13-400.3.B Method B Forms. An accurately completed Form 400B-07 (generated by the EnergyGauge Summit–Fla/Com 2007 computer program) demonstrating that code compliance has been achieved shall be submitted to the building official for Method B compliance. Calculations shall be performed for the building's location.

13-400.3.C Method C Forms. An accurately completed Form 400C-07 demonstrating that code compliance has been achieved shall be submitted to the building official for Method C compliance. The form submitted shall be specific for the climate zone in which the building will be located. See Section 13-202 for ASHRAE Climate Zone definitions.

13-400.4.ABC Reporting. A copy of the front page of the 400 series form submitted to demonstrate code compliance shall be sent by the building official to the Florida Building Commission on a quarterly basis for reporting purposes.

TABLE 13-400.ABC.3
INDEX TO COMMERCIAL CODE COMPLIANCE FORMS

METHOD	FORM NO.
Method A Whole Building Performance	Form 400A-07 (EnergyGauge Summit Fla/Com Computer printout)
Method B Building Envelope Trade-off	Form 400B-07 (EnergyGauge Summit Fla/Com Computer printout)
Method C Buildings Prescriptive Envelope	Form 400C-07 (separate forms for ASHRAE Climate Zones 1 and 2

SECTION 13-401
FENESTRATIONS (Glazing)

13-401.A Requirements specific to Method A. The fenestrations' solar heat gain coefficient and *U*-factor determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance levels allowed (maximum SHGC and *U*-factor).

13-401.B Requirements specific to Method B. The fenestrations' solar heat gain coefficient and *U*-factor determined by the EnergyGauge Summit Fla/Com Method B performance calculation to demonstrate compliance with this code shall be the minimum performance levels allowed (maximum SHGC and *U*-value).

13-401.C Requirements specific to Method C. Fenestration areas of buildings complying by Method C shall be no higher than that specified on Form 400C for that occupancy type. Compliance with *U-factors* and *solar heat gain coefficient (SHGC)* shall be demonstrated for the overall fenestration product, including glass, sash, and frame, as shall be determined from manufacturer's product specification sheets in accordance with applicable test procedures. Gross wall areas and gross roof areas shall be calculated separately for each *space-conditioning category* for the purposes of determining compliance.

Exception: If there are multiple assemblies within a single *class of construction* for a single *space-conditioning category*, compliance shall be based on an area-weighted average *U-factor* or *SHGC*. It is not acceptable to do an area-weighted average across multiple *classes of construction* or multiple *space-conditioning categories*.

Glazing in doors shall be included in the fenestration area.

13-401.C.1 Fenestration area. The total *vertical fenestration area* shall be less than 50 percent of the *gross wall area.*

Exception: *Vertical fenestration* complying with Exception 3 to Section 13-401.C.3.

The total *skylight area* shall be less than 5 percent of the *gross roof area.*

13-401.C.2 Fenestration *U*-factor. *Fenestration* shall have a *U*-factor not greater than that specified on Form 400C for the appropriate *fenestration area. U-factor* for *fenestration* shall be determined in accordance with manufacturer's product specification sheets in accordance with applicable test procedures.

Exception: Vertical fenestration complying with Exception 3 to 13-401.C.3 shall have a *U-factor not* greater than that specified for 40 percent of the *gross wall area.*

13-401.C.3 Fenestration Solar Heat Gain Coefficient (SHGC).

13-401.C.3.1 *Vertical fenestration* shall have an *SHGC* not greater than that specified for "all" orientations on Form 400C for the appropriate total *vertical fenestration area.*

13-401.C.3.2 *Skylights* shall have an *SHGC* not greater than that specified for "all" orientations on Form 400C for the appropriate total *skylight area.*

Exceptions:

1. The *SHGC* for *north-oriented vertical fenestration* shall be calculated separately and shall not be greater than that specified in Form 400C for *north-oriented fenestration*. When this exception is used, the *fenestration area* used in selecting the criteria shall be calculated separately for *north-oriented* and all other-oriented *fenestration*.
2. For demonstrating compliance for *vertical fenestration* only, the *SHGC* in the proposed building shall be reduced by using the multipliers in Table 13-401.C.3 for each *fenestration* product shaded by permanent projections that will last as long as the building itself.
3. *Vertical fenestration* that is located on the street side of the street-level story only, provided that 1) the street side of the street-level story does not exceed 20 feet (6096 mm) in height, 2) the *fenestration* has a continuous overhang with a weighted average *projection factor* greater than 0.5, and 3) the *fenestration area* for the street side of the street-level story is less than 75 percent of the *gross wall area* for the street side of the street-level story. When this exception is utilized, separate calculations shall be performed for these sections of the *building envelope*, and these values shall not be averaged with any others for compliance purposes. No credit shall be given here or elsewhere in the building for not fully utilizing the *fenestration area* allowed.

TABLE 13-401.C.3
SHGC Multipliers for Permanent Projections

Projection Factor	SHGC Multiplier (All Other Orientations)	SHGC Multiplier (North-Oriented)
0 – 0.10	1.00	1.00
<0.10 – 0.20	0.91	0.95
<0.20 – 0.30	0.82	0.91
<0.30 – 0.40	0.74	0.87
<0.40 – 0.50	0.67	0.84
<0.50 – 0.60	0.61	0.81
<0.60 – 0.70	0.56	0.78
<0.70 – 0.80	0.51	0.76
<0.80 – 0.90	0.47	0.75
<0.90 – 1.00	0.44	0.73

SECTION 13-402
WALLS

13-402.A Requirements specific to Method A. Efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in walls.

13-402.B Requirements specific to Method B. Efficiencies determined by the EnergyGauge Summit Fla/Com Method B performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in walls.

13-402.C Requirements specific to Method C. When a *wall* consists of both *above-grade* and *below-grade* portions, the entire *wall* for that story shall be insulated on either the exterior or the interior or be integral. If insulated on the interior, the *wall* shall be insulated to the *above-grade wall* requirements. If insulated on the exterior or integral, the *below-grade wall* portion shall be insulated to the *below-grade wall* requirements, and the *above-grade wall* portion shall be insulated to the *above-grade wall* requirements.

13-402.C.1 Above-grade wall insulation. All *above-grade walls* shall have a *rated R-value of insulation* not less than that specified in Form 400C. Mass wall heat capacity shall be determined from Table B-10 or B-11, as appropriate.

13-402.C.2 Below-grade wall insulation. *Below-grade walls* shall have a *rated R-value of insulation* not less than that specified in Form 400C. For *below-grade walls*, the *rated R-value of insulation* is for *continuous insulation* uninterrupted by framing. Where framing, including metal and wood studs, is used, compliance shall be based on the maximum assembly *C-factor*.

SECTION 13-403
DOORS

13-403.ABC Mandatory requirements for Methods A, B and C.

13-403.ABC. 1 Door types allowed. All *exterior* and *adjacent* doors other than glass doors shall meet the *U*-factor specified on Form 400C. Hollow core doors shall not be used in either *exterior* or *adjacent walls*. Doors may have glass sections.

13-403.A Requirements specific to Method A. Efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in doors.

13-403.B Requirements specific to Method B. Efficiencies determined by the EnergyGauge Summit Fla/Com Method B performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in doors.

13-403.C Requirements specific to Method C.

13-403.C.1 Opaque doors. All *opaque doors*, including *swinging doors* and nonswinging doors, shall have a *U-factor* not greater than that specified on Form 400C.

SECTION 13-404
ROOFS/CEILINGS

13-404.ABC Mandatory requirements for Methods A, B, and C.

13-404.ABC.1 Roof/ceiling thermal envelopes. The roof or ceiling which functions as the building's thermal envelope shall be insulated to an *R*-value of at least R-10. Roof insulation shall not be installed on a suspended ceiling with removable ceiling panels. Where cavities beneath a roof deck are ventilated, the ceiling shall be considered the envelope component utilized in the EnergyGauge Summit Fla/Com calculation.

13-404.ABC.2 Cavities used as plenums. Cavities beneath a roof deck which will be used as supply or return plenums shall have an insulated roof. The insulation shall have a *R*-value of at least R-19.

13-404.ABC.3 Vented cavities above dropped ceilings. Where cavities beneath a roof deck are not sealed from the outside environment, the ceiling shall be treated as the exterior thermal and pressure envelopes of the building.

13-404.A Requirements specific to Method A. Efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in roofs/ceilings.

Multiple-family residential roofs/ceilings shall be insulated. The insulation shall have a *R*-value of at least R-19, space permitting.

13-404.B Requirements specific to Method B. Efficiencies determined by the EnergyGauge Summit Fla/Com Method B performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in roofs/ceilings. Multiple-family residential roofs/ceilings shall be insulated with an insulation *R*-value of at least R-19, space permitting.

13-404.C Requirements specific to Method C.

13-404.C.1 Roof insulation. All *roofs* shall have a *rated R-value of insulation* not less than that specified on Form 400C. *Skylight* curbs shall be insulated to the level of *roofs with insulation entirely above the deck* or R-5, whichever is less.

Exception: For roofs where the exterior surface has a minimum total solar reflectance of 0.70 when tested in accordance with one of the solar reflectance test methods listed below, and has a minimum thermal emittance of 0.75 when tested in accordance with one of the thermal emittance test methods listed below, other than roofs with ventilated attics or roofs with semiheated spaces, the *U*-factor of the proposed roof shall be permitted to be adjusted using Equation 4-1 for demonstrating compliance. The values for solar reflectance and thermal emittance shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the Cool Roof Rating Council CCRC-1 Product Rating program, and shall be labeled and certified by the manufacturer.

$$U_{RoofAdj} = U_{RoofProposed} \times Factor_{RoofMultiplier} \quad \textbf{Equation (4-1)}$$

where:

$U_{RoofAdj}$ = the adjusted roof *U*-factor for use in demonstrating compliance.

$U_{RoofProposed}$ = the *U*-factor of the proposed roof, as designed.

$Factor_{RoofMultiplier}$ = the roof *U*-factor multiplier from Table 404.1.C.1.B.

Solar Reflectance Test Methods: ASTM C 1549, ASTM E 903, or ASTM E 1918.

Thermal Emittance Test Methods: ASTM C 1371 or ASTM E 408.

TABLE 13-404.C.1
ROOF *U*-FACTOR MULTIPLIERS FOR EXCEPTION TO 13-404.C.1

Climate Zone	Roof *U*-Factor Multiplier
ASHRAE Climate Zone 1	0.77
ASHRAE Climate Zone 2	0.83

SECTION 13-405
FLOORS

13-405.A Requirements specific to Method A. Efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in floors.

13-405.B Requirements specific to Method B. Efficiencies determined by the EnergyGauge Summit Fla/Com Method B performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in floors.

13-405.C Requirements specific to Method C.

13-405.C.1 Floor insulation. All *floors* shall have a *rated R-value of insulation* not less than that specified on Form 400C.

13-405.C.2 Slab-on-grade floor insulation. All *slab-on-grade floors* shall have a rated *R-value of insulation* not less than that specified on Form 400C and shall be installed around the perimeter of the *slab-on-grade floor* to the distance specified.

SECTION 13-406
AIR INFILTRATION

13-406.ABC Mandatory requirements for Methods A, B and C. The requirements of this section shall apply only to those locations that separate interior building conditioned space from the outdoors or from unconditioned space or crawl spaces. Compliance with the criteria for air leakage through building components shall be determined by tests conducted in accordance with ASTM E 283.

13-406.ABC.1 Minimum infiltration levels allowed.

13-406.ABC.1.1 Exterior doors and windows. Air leakage for *fenestration* and *doors* shall be determined in

accordance with NFRC 400. Air leakage shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be *labeled* and certified by the manufacturer. Air leakage shall not exceed 1.0 cubic foot per minute (cfm) per square foot [.005 $m^3/(s \cdot m^2)$] for glazed swinging entrance doors and for revolving doors and 0.4 cubic foot per minute (cfm) per square foot [.005 $m^3/(s \cdot m^2)$]for all other products.

Exceptions:

(a) Field-fabricated fenestration and doors.
(b) For garage *doors*, air leakage determined by test at standard test conditions in accordance with ANSI/DASMA 105 shall be an acceptable alternate for compliance with air leakage requirements.

13-406.ABC.1.2 Exterior joints in the envelope. The following areas of the *building envelope* shall be sealed, caulked, gasketed, or weather-stripped to minimize air leakage:

a. Joints around *fenestration* and *door* frames.
b. Junctions between *walls* and foundations, between *walls* at building corners, between *walls* and structural *floors* or *roofs*, and between *walls* and *roof* or *wall* panels.
c. Openings at penetrations of utility services through *roofs*, *walls*, and *floors*.
d. Site-built *fenestration* and *doors*.
e. Building assemblies used as ducts or plenums.
f. Joints, seams, and penetrations of vapor retarders.
g. All other openings in the *building envelope*.

13-406.ABC.2 Apertures in the building envelope. Any intentional apertures or openings in walls, ceilings or floor between conditioned and unconditioned space (such as hydrostatic openings in stairwells for coastal buildings) shall have dampers which limit air flow between the spaces.

13-406.ABC.3 Building cavities.

13-406.ABC.3.1 Where vented dropped ceiling cavities occur over conditioned spaces, the ceiling shall be considered to be both the upper thermal envelope and pressure envelope of the building and shall contain a continuous air barrier between the conditioned space and the vented unconditioned space that is also sealed to the air barrier of the walls.

IMPORTANT NOTE: See the definition of "Air barrier" in Section 13-202.

13-406.ABC.3.2 Where unvented dropped ceiling cavities occur over conditioned spaces that do not have an air barrier between the conditioned and unconditioned space (such as T-bar ceilings), they shall be completely sealed from the exterior environment (at the roof plane) and adjacent spaces by a continuous air barrier that is also sealed to the air barrier of the walls. In that case, the roof assembly shall constitute both the upper thermal envelope and pressure envelope of the building.

13-406.ABC.3.3 Unconditioned spaces above separate tenancies shall contain dividing partitions between the tenancies to form a continuous air barrier that is sealed at the ceiling and roof to prevent air flow between them.

13-406.ABC.3.4 Building cavities designed to be air distribution system components shall be sealed according to the criteria for air ducts, plenums, etc., in Section 13-410.ABC.3.6.

SECTION 13-407
SPACE COOLING SYSTEMS

13-407.0 Applicability. This section covers the determination of minimum cooling system design requirements and efficiencies. The requirements of this section apply to equipment and mechanical component performance of all air conditioning systems installed in new and renovated buildings including, but not limited to: unitary (central) cooling equipment (air-cooled, water-cooled and evaporatively cooled); the cooling mode of unitary (central) and packaged terminal heat pumps (air source and water source); packaged terminal air conditioners; roof air conditioners; room air conditioners; and heat-operated cooling equipment such as absorption equipment, engine-driven equipment and turbine-driven equipment.

13-407.ABC Mandatory requirements for Methods A, B and C.

13-407.ABC.1 Sizing. A cooling load calculation shall be performed for newly installed units as per criteria of Section B3.1 of Appendix 13-B of this chapter. This calculation shall be attached to the code compliance form submitted to the building department when the building is permitted or, in the event the mechanical permit is obtained at a later time, the sizing calculation shall be submitted with the application for the mechanical permit.

Exceptions:

1. Where mechanical systems are designed by an engineer registered in the state of Florida, the engineer has the option of submitting a signed and sealed summary sheet in lieu of the complete sizing calculation(s). Such summary sheet shall include the following (by zone):

Project name/owner	Outdoor dry bulb used	Total heating required with outside air
Project address	Outdoor wet bulb used	Total sensible gain
Sizing method used	Relative humidity	Total latent gain
Area in square feet.	Indoor dry bulb	Grains water (difference)

Total cooling required with outside air

2. Systems installed in existing buildings not meeting the definition of renovation in Section 13-202.

13-407.ABC.1.1 HVAC systems and equipment shall be sized to provide no more than the space and system loads calculated in accordance with Section 13-407.ABC.1. A

single piece of equipment providing both cooling and heating shall satisfy this provision when the cooling function meets the provisions of Section 13-407.ABC.1, and the heating function is sized as small as possible to meet the load within available equipment options.

Exceptions:

1. When the equipment selected is the smallest size needed to meet the load within available options of the desired equipment line.
2. Stand-by equipment provided with controls and devices that allow such equipment to operate automatically only when the primary equipment is not operating.
3. Multiple units of the same equipment type with combined capacities exceeding the design load and are provided with controls that sequence or otherwise optimally control the operation of each unit based on load.

13-407.ABC.1.2 Buildings which contain assembly occupancies shall have equipment sized or controlled to prevent continuous space cooling or heating of such spaces with peak capacity equipment by the following options:

1. Equipment is staged to include cooling or heating to the space and stages are controlled by an electronically controlled energy management system.
2. A separate cooling or heating system is utilized to provide cooling or heating to the assembly occupancy.
3. A variable speed compressor is utilized to provide incremental cooling or heating to the assembly occupancy.

13-407.ABC.2 Controls.

13-407.ABC.2.1 Zone controls. Zone thermostatic controls shall be capable of operating in sequence the supply of heating and cooling energy to the zone. Such controls shall prevent: (1) reheating; (2) recooling; (3) mixing or simultaneously supplying air that has been previously mechanically heated and air that has been previously cooled, either by mechanical cooling or by economizer systems; and (4) other simultaneous operation of heating and cooling systems to the same zone.

Exceptions:

a. Zones for which the volume of air that is reheated, recooled, or mixed is no greater than the larger of the following:
   1. The volume of outside air required to meet the ventilation requirements of Section 6.1.3 of ASHRAE 62 for the zone.
   2. 0.4 per square foot [.002 $m^3/(s \cdot m^2)$] of the zone conditioned floor area.
   3. Thirty percent of the zone design peak supply rate.
   4. Three-hundred cfm (.14 m^3/s). This exception is for zones whose peak flow rate totals no more than 10 percent of the total fan system flow rate.
   5. Any higher rate that can be demonstrated, to the satisfaction of the authority having jurisdiction, to reduce overall system annual energy usage by offsetting reheat/recool energy losses through a reduction in outdoor air intake in accordance with Method A of this subchapter.

b. Zones where special pressurization relationships, cross-contamination requirements, or code-required minimum circulation rates are such that variable air volume systems are impractical.

c. Zones where at least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered (including condenser heat) or site-solar energy source.

d. Systems that are designed and dedicated to condition only the outdoor ventilation air stream to meet the requirements of ASHRAE 62. Such systems shall be controlled so that they do not allow overcooling of the building. Any building utilizing this exception that has a system that requires reheat, other than reclaimed waste heat, shall comply by Method A of this code.

13-407.ABC.2.2 Hot gas bypass limitation. Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited to the following:.

Rated Capacity	Max. Hot Gas Bypass Capacity (percent Total Capacity)
≤240,000 Btu/h	50 percent
>240,000 Btu/h	25 percent

Exception: Unitary packaged systems with cooling capacities not greater than 90,000 Btu/h (432 W).

13-407.ABC.2.3 Temperature controls.

13-407.ABC.2.3.1 General. The supply of heating and cooling energy to each zone shall be individually controlled by thermostatic controls responding to temperature within the zone. For the purposes of this section, a dwelling unit shall be permitted to be considered a single zone.

Exception: Independent perimeter systems that are designed to offset only building envelope loads shall be permitted to serve one or more zones also served by an interior system provided:

1. The perimeter system includes at least one thermostatic control zone for each building exposure having exterior walls facing only one orientation for 50 contiguous feet (15 240 mm) or more, and
2. The perimeter system heating and cooling supply is controlled by a thermostatic control(s) located within the zones(s) served by

the system. Exterior walls are considered to have different orientations if the directions they face differ by more than 45 degrees.

13-407.ABC.2.3.2 Dead band. Where used to control both heating and cooling, zone thermostatic controls shall be capable of providing a temperature range or dead band of at least 5°F (-15°C) within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exceptions:

1. Thermostats that require manual changeover between heating and cooling modes.
2. Special occupancy or special applications where wide temperature ranges are not acceptable (such as retirement homes, process applications, data processing, museums, some areas of hospitals) and are approved by the authority having jurisdiction.
3. In the case of VAV systems, the deadband may be reduced to $2^1/_2$°F
4. (-16°C) if the occupant control of the thermostat is programmed to limit the adjustment of the VAV system zone temperature to plus or minus $1^1/_2$°F (-17°C) from the thermostat set point.

13-407.ABC.2.3.3 Set point overlap restriction. Where heating and cooling to a zone are controlled by separate zone thermostatic controls located within the zone, means (such as limit switches, mechanical stops, or, for DDC systems, software programming) shall be provided to prevent the heating set point from exceeding the cooling set point minus any applicable proportional band.

13-407.1.ABC.2.4 Humidity control.

13-407.ABC.2.4.1 Dehumidification. Where humidistatic controls are provided, such controls shall prevent reheating, mixing of hot and cold airstreams, or other means of simultaneous heating and cooling of the same airstream.

Exceptions:

1. The system is capable of reducing supply air volume to 50 percent or less of the design airflow rate or the minimum rate specified in Section 6.1.3 of ASHRAE 62, whichever is larger, before simultaneous heating and cooling takes place.
2. The individual fan cooling unit has a design cooling capacity of 80,000 Btu/h (23 448 W) or less and is capable of unloading to 50-percent capacity before simultaneous heating and cooling takes place.
3. The individual mechanical cooling unit has a design cooling capacity of 40,000 Btu/h (11 724 W) or less. An individual mechanical cooling unit is a single system composed of a fan or fans and a cooling coil capable of providing mechanical cooling.
4. Systems serving spaces where specific humidity levels are required to satisfy process needs, such as computer rooms, museums, surgical suites, and buildings with refrigerating systems, such as supermarkets, refrigerated warehouses, and ice arenas. This exception also applies to other applications for which fan volume controls in accordance with Exception 1 are proven to be impractical to the enforcement agency.
5. At least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided_from a site-recovered (including condenser heat) or site solar energy source.
6. Systems where the heat added to the airstream is the return air enthalpy result of the use of a desiccant system and 75 percent of the heat added by the desiccant system is removed by a heat exchanger, either before or after the desiccant system with energy recovery.

13-407.ABC.2.4.2 Humidifier preheat. Humidifiers with preheating jackets mounted in the airstream shall be provided with an automatic valve to shut off preheat when humidification is not required.

13-407.ABC.2.4.3 Humidification and dehumidification. Where a zone is served by a system or systems with both humidification and dehumidification capability, means (such as limit switches, mechanical stops, or, for DDC systems, software programming) shall be provided capable of preventing simultaneous operation of humidification and dehumidification equipment.

Exceptions:

1. Zones served by desiccant systems, used with direct evaporative cooling in series.
2. Systems serving zones where specific humidity levels are required, such as computer rooms, museums, and hospitals, and approved by the building official.

13-407.ABC.2.5 Off-hour controls. HVAC systems having a design heating or cooling capacity greater than 65,000 Btu/h (19 051W) and fan system power greater than $^3/_4$ hp shall have all of the following off-hour controls: Automatic Shutdown (13-407.ABC.2.4.1), Setback Controls (13-408.ABC.2.1), Optimum Start Controls (13-407.ABC.2.4.2), Shutoff Damper Controls (13-409.ABC.3.3), and Zone Isolation (13-407.ABC.2.4.3).

Exceptions:

1. HVAC systems serving hotel/motel guest rooms.

2. HVAC systems intended to operate continuously.
3. HVAC systems having a design heating capacity and cooling capacity less than 15,000 Btu/h (4396 W) that are equipped with readily accessible manual on/off controls.

13-407.ABC.2.5.1 Automatic shutdown. HVAC systems shall be equipped with at least one of the following:

1. Controls that can start and stop the system under different time schedules for seven different day-types per week, are capable of retaining programming and time setting during loss of power for a period of at least 10 hours, and include an accessible manual override, or equivalent function, that allows temporary operation of the system for up to 2 hours.
2. An occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.
3. A manually operated timer capable of being adjusted to operate the system for up to two hours.
4. An interlock to a security system that shuts the system off when the security system is activated.

Exception: Residential occupancies may use controls that can start and stop the system under two different time schedules per week.

13-407.ABC.2.5.2 Optimum start controls. Individual heating and cooling air distribution systems with a total design supply air capacity exceeding 10,000 cfm (5 m^3/s), served by one or more supply fans, shall have optimum start controls. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint and the amount of time prior to scheduled occupancy.

13-407.ABC.2.5.3 Zone isolation. HVAC systems serving zones that are intended to operate or be occupied nonsimultaneously shall be divided into isolation areas. Zones may be grouped into a single isolation area provided it does not exceed 25,000 square feet (2323 m^3) of conditioned floor area nor include more than one floor. Each isolation area shall be equipped with isolation devices capable of automatically shutting off the supply of conditioned air and outside air to and exhaust air from the area. Each isolation area shall be controlled independently by a device meeting the requirements of Section 13-407.ABC.5.1 (Automatic Shutdown). For central systems and plants, controls and devices shall be provided to allow stable system and equipment operation for any length of time while serving only the smallest isolation area served by the system or plant.

Exceptions: Isolation devices and controls are not required for the following:

1. Exhaust air and outside air connections to isolation zones when the fan system to which they connect is 5,000 cfm (2.4 m^3/s) and smaller.
2. Exhaust airflow from a single isolation zone of less than 10 percent of the design airflow of the exhaust system to which it connects.
3. Zones intended to operate continuously or intended to be inoperative only when all other zones are inoperative.

13-407.ABC.2.6 Controls testing. HVAC control systems shall be tested to ensure that control elements are calibrated, adjusted, and in proper working condition.

13-407.ABC.3 Equipment performance standards.

13-407.ABC.3.1 Equipment efficiency verification. Equipment efficiency information supplied by manufacturers shall be verified as follows:

1. Equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall comply with U.S. Department of Energy certification requirements.
2. If a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program, or
3. If a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, but the product is not listed in the existing certification program, the ratings shall be verified by an independent laboratory test report, or
4. If no certification program exists for a covered product, the equipment efficiency ratings shall be supported by data furnished by the manufacturer, or
5. Where components such as indoor or outdoor coils from different manufacturers are used, the system designer shall specify component efficiencies whose combined efficiency meets the minimum equipment efficiency requirements in Section 13-407.ABC.3.
6. Products covered in Table 13-407.ABC.3.2G shall have efficiency ratings supported by data furnished by the manufacturer.

13-407.ABC.3.2 Minimum efficiencies for cooling equipment.

13-407.ABC.3.2.1 Minimum equipment efficiencies–listed equipment–standard rating and operating conditions. Equipment shown in Tables 13-407.ABC.3.2A through 13-407.ABC.3.2D shall have a minimum performance at the specified rating conditions when tested in accordance with the specified test procedure. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements, unless otherwise exempted by footnotes in the table. Equipment

covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum efficiency requirements for operation at minimum capacity or other than standard rating conditions. Equipment used to provide water heating functions as part of a combination system shall satisfy all stated requirements for the appropriate space heating or cooling category.

Tables 13-407.ABC.3.2.1A through 13-407.ABC.3.2.1D and 13-407.ABC.3.2.1G contain the minimum efficiency requirements for equipment covered by this section of the standard. The tables are organized to cover the following types of equipment:

Table 13-407.ABC.3.2.1A, Air Conditioners and Condensing Units
Table 13-407.ABC.3.2.1B, Heat Pumps
Table 13-407.ABC.3.2.1C, Water Chilling Packages (see Section 13-407.ABC.3.2.2 for water-cooled centrifugal water-chilling packages that are designed to operate at nonstandard conditions).
Table 13-407.ABC.3.2.1D, Packaged Terminal and Room Air Conditioners and Heat Pumps.
Table 13-407.ABC.3.2.1G Heat Rejection Equipment.

13-407.ABC.3.2.2 Minimum equipment efficiencies – listed equipment – nonstandard conditions. Water-cooled centrifugal water-chilling packages that are not designed for operation at ARI 550/590 test conditions (and thus cannot be tested to meet the requirements of Table 13-407.ABC.3.2.1C) of 44°F (7°C) leaving chilled water temperature and 85°F (29°C) entering condenser water temperature shall have a minimum full-load COP and a minimum NPLV rating as shown in Tables 13-407.ABC.3.2.2H, 13-407.ABC.3.2.2I and 13-407.ABC.3.2.2J referenced below.

1. Centrifugal chillers <150 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 13-407.ABC.3.2.2H.
2. Centrifugal chillers ≥ 150 tons and <300 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 13-407.ABC.3.2.2I.
3. Centrifugal chillers ≥300 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 13-407.ABC.3.2.2J.

The table values are only applicable over the following full-load design ranges:

Leaving Chiller Water Temperature: 40°F to 48°F (4°C to 9°C).
Entering Condenser Water Temperature: 75°F to 85°F (24°C to 29°C).
Condensing Water Temperature Rise: 5°F to 15°F (-15°C to 9°C).

Chillers designed to operate outside of these ranges or applications utilizing fluids or solutions with secondary coolants (e.g. glycol solutions or brines) with a freeze point of 27°F (-2.8°C) or less for freeze protection are not covered by this standard.

Non-standard part-load value (NPLV) is defined as a single-number part-load efficiency figure of merit for chillers referenced to conditions other than integrated part-load value (IPLV) conditions.

13-407.ABC.3.2.3 Equipment not listed. Equipment not listed in the tables referenced in Sections 13-407.ABC.3.2.1 and 13-407.ABC.3.2.2 may be used.

13-407.ABC.3.3 Condensing coils installed in cool air stream of another air-conditioning unit. The condensing coil of one air-conditioning unit shall not be installed in the cool air stream of another air-conditioning unit.

Exceptions:

1. Where condenser heat reclaim is used in a properly designed system including enthalpy control devices to achieve requisite humidity control for process, special storage or equipment spaces and occupant comfort within the criteria of ASHRAE 55. Such systems shall result in less energy use than other appropriate options.
2. For computer or clean rooms whose location precludes the use of systems which would not reject heat into conditioned spaces.

13-407.ABC.3.4 Exhaust air energy recovery for cooling systems. Individual fan systems that have both a design supply air capacity of 5,000 cfm (2.4 m^3/s) or greater and have a minimum outside air supply of 70 percent or greater of the design supply air quantity shall have an energy recovery system with at least 50 percent recovery effectiveness. Fifty-percent energy recovery effectiveness shall mean a change in the enthalpy of the outdoor air supply equal to 50 percent of the difference between the outdoor air and return air at design conditions.

Exceptions:

1. Laboratory systems meeting Section 13-409.ABC.3.6.2.
2. Systems serving spaces that are not cooled and that are heated to less than 60°F (16°C).
3. Systems exhausting toxic, flammable, paint or corrosive fumes or dust.
4. Commercial kitchen hoods (grease) used for collecting and removing grease vapors and smoke.
5. Where the largest exhaust source is less than 75 percent of the design outdoor airflow.
6. Systems requiring dehumidification that employ series-style energy recovery coils wrapped around the cooling coil.

13-407.A Requirements specific to Method A. Cooling system efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in buildings.

13-407.BC Requirements specific to Methods B and C. Cooling system minimum efficiency requirements for buildings complying by Methods B and C shall meet or exceed the code minimum for the equipment installed per Tables 13-407.ABC.3.2.1A through 13-407.ABC.3.2.1D and 13-407.ABC.3.2.1G.

Electric resistance reheat shall not be used when complying with this code by Methods B and C.

SECTION 13-408
SPACE HEATING EQUIPMENT

13-408.0 Applicability. This section covers the determination of minimum heating system design requirements and efficiencies. The requirements of this section apply to equipment and mechanical component performance of all heating systems installed in new and renovated buildings including, but not limited to: unitary central heat pumps, either air or water source in the heating mode; water source (hydronic) heat pumps as used in multiple unit hydronic HVAC systems; packaged terminal heat pumps and room air conditioner heat pumps in the heating mode; and all gas- and oil-fired warm air furnaces, boilers and direct heating equipment.

13-408.ABC Mandatory requirements for Methods A, B and C.

13-408.ABC.1 Sizing. Heating equipment and systems shall be sized to provide no more than the space and system loads calculated in accordance with Section 13-407.ABC.1, with exceptions.

13-408.ABC.2 Controls. Heating equipment and systems shall meet all applicable prescriptive requirements for controls in Section 13-407.ABC.2.

13-408.ABC.2.1 Setback controls. Heating systems shall be equipped with controls that have the capability to automatically restart and temporarily operate the system as required to maintain *zone* temperatures above a heating set point adjustable down to 55°F (13°C) or lower.

Exception: Buildings located in Miami-Dade, Broward or Monroe Counties.

13-408.ABC.2.2 Heat pump auxiliary heat control. Heat pumps equipped with internal electric resistance heaters shall have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during outdoor coil defrost cycles. Two means of meeting this requirement are (1) a digital or electronic thermostat designed for heat pump use that energizes auxiliary heat only when the heat pump has insufficient capacity to maintain setpoint or to warm up the space at a sufficient rate, or (2) a multistage space thermostat and an outdoor air-thermostat wired to energize auxiliary heat only on the last stage of the space thermostat and when outside air temperature is less than 40°F (4°C).

Exception: Heat pumps whose minimum efficiency is regulated by NAECA and whose HSPF rating both meets the requirements shown in Table 13-407.ABC.3.2.1B and includes all usage of internal electric resistance heating.

13-408.ABC.2.3 Freeze protection. Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include automatic controls capable of shutting off the systems when outside air temperatures are above 40°F (4°C) or when the conditions of the protected fluid will prevent freezing.

13-408.ABC.3 Equipment performance standards.

13-408.ABC.3.1 Equipment efficiency verification. If a certification program exists for a product covered in Tables 13-408.ABC.3.21E through 13-408.ABC.3.2.1F, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be either listed in the certification program or, alternatively, the ratings shall be verified by an independent laboratory test report. If no certification program exists for a product covered in Tables 13-408.ABC.3.2.1E through 13-408.ABC.3.2.1F, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where equipment is not rated, a Florida-registered engineer shall specify component efficiencies whose combined efficiency meets the minimum equipment efficiency requirements in Section 13-408.ABC.3.2.1.

13-408.ABC.3.2 Minimum efficiencies for heating equipment.

13-408.ABC.3.2.1 Equipment ratings. Tables 13-407.ABC.3.2.1B, 13-407.ABC.3.2.1D, and 13-408.ABC.3.2.1E through 13-408.ABC.3.2.1F contain the minimum efficiency requirements for equipment covered by this section of the standard. The tables are organized to cover the following types of equipment:

Table 13-407.ABC.3.2.1B, Heat Pumps
Table 13-407.ABC.3.2.1D, Packaged Terminal Air Conditioners and Heat Pumps
Table 13-408.ABC.3.2.1E, Furnaces, Duct Furnaces and Unit Heaters
Table 13-408.ABC.3.2.1F, Boilers

All furnaces with input ratings ≥225,000 Btu/h, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input.

13-408.ABC.3.2.2 Radiant heating systems.

13-408.ABC.3.2.2.1 Heating unenclosed spaces. Radiant heating shall be used when heating is required for unenclosed spaces.

Exception: Loading docks equipped with air curtains.

13-408.ABC.3.2.2.2 Heating enclosed spaces. Radiant heating systems that are used as primary or supplemental enclosed space heating shall be in conformance with the governing provisions of this subchapter, including, but not limited, to the following:

TABLE 13-407.ABC.3.2.1A
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[2]	Test Procedure[1]
Air Conditioners, Air Cooled	< 65,000 Btu/h[3]	All	Split System	13.0 SEER	ARI 210/240
			Single Package	13.0 SEER	
	≥ 65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.3 EER	
		All other	Split System and Single Package	10.1 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.7 EER	ARI 340/360
		All other	Split System and Single Package	9.5 EER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER, 9.7 IPLV	
		All other	Split System and Single Package	9.3 EER, 9.5 IPLV	
	>760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.2 EER, 9.4 IPLV	
		All other	Split System and Single Package	9.0 EER, 9.2 IPLV	
Through-the-Wall, Air Cooled	<30,000 Btu/h[3]	All	Split System	10.9 SEER	ARI 210/240
			Single Package	10.6 SEER	
Small-Duct High-Velocity, Air Cooled	<65,000 Btu/h[3]	All	Split System or Single Package	11.0 SEER[4]	ARI 210/240
Space constrained products, air conditioners	<65,000 Btu/h[3]	All	Split System or Single Package	12.0 SEER	ARI 210/240
Air Conditioners, Water and Evaporatively Cooled	<65,000 Btu/h	All	Split System and Single Package	12.1 EER	ARI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.5 EER	
		All other	Split System and Single Package	11.3 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER	ARI 340/360
		All other	Split System and Single Package	10.8 EER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER, 10.3 IPLV	
		All other	Split System and Single Package	10.8 EER, 10.1 IPLV	
Condensing Units, Air Cooled	≥135,000 Btu/h			10.1 EER, 11.2 IPLV	ARI 365
Condensing Units, Water or Evaporatively Cooled	≥135,000 Btu/h			13.1 EER, 13.1 IPLV	

1. Subchapter 13-3 contains a complete specification of the reference test procedure, including the referenced year version of the test procedure.
2. IPLVs and part load rating conditions are only applicable to equipment with capacity modulation.
3. Single-phase, air-cooled air-conditioners <65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.
4. As granted by U.S. Department of Energy letter of exception specific to individual companies, SDHV products without a letter of exception shall have the same efficiency as air-cooled air-conditioners.

TABLE 13-407.ABC.3.2.1B
ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[2]	Test Procedure[1]
Air Cooled (Cooling Mode)	<65,000 Btu/h[3]	All	Split System	13.0 SEER	ARI 210/240
			Single Package	13.0 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.1 EER	
		All other	Split System and Single Package	9.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.3 EER	ARI 340/360
		All other	Split System and Single Package	9.1 EER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.0 EER 9.2 IPLV	
		All other	Split System and Single Package	8.8 EER 9.0 IPLV	
Through-the-Wall, Air Cooled	<30,000 Btu/h[3]	All	Split System	10.9 SEER	ARI 210/240
			Single Package	10.6 SEER	
Small-Duct High-Velocity, Air Cooled, Cooling Mode	<65,000 Btu/h[3]	All	Split System	11.0 SEER[4]	ARI 210/240
Air Cooled (Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity		Split System	7.7 HSPF	ARI 210/240
			Single Package	7.7 HSPF	
Through-the-Wall (Air Cooled, Heating Mode)	<30,000 Btu/h[3] (Cooling Capacity)		Split System	7.1 HSPF	ARI 210/240
			Single Package	7.0 HSPF	
Small-Duct High-Velocity (Air Cooled, Heating Mode)	>65,000 Btu/h[3] (Cooling Capacity)		Split System or Single Package	7.7 HSPF[4]	ARI 210/240
Space Constrained Products, Heat Pumps	<65,000Btu/h[3]		Split System or Single Package	7.4 HSPF	ARI 210/240
Water Source (Cooling Mode)	<17,000 Btu/h	All	86°F Entering Water	11.2 EER	ISO-13256-1
	≥17,000 Btu/h and <135,000 Btu/h	All	86°F Entering Water	12.0 EER	
Groundwater Source (Cooling Mode)	<135,000 Btu/h	All	59°F Entering Water	16.2 EER	
Ground Source (Cooling Mode)	<135,000 Btu/h	All	77°F Entering Water	13.4 EER	
Air Cooled (Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity)		Split System	7.7 HSPF	ARI 210/240
			Single Package	7.7 HSPF	
	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)		47°F db/43°F wb Outdoor Air 17°F db/15°F wb Outdoor Air	3.2 COP 2.2 COP	
	≥135,000 Btu/h (Cooling Capacity)		47°F db/43°F wb Outdoor Air 17°F db/15°F wb Outdoor Air	3.1 COP 2.0 COP	ARI 340/360
Water-Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		68°F Entering Water	4.2 COP	ISO-13256-1
Groundwater Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		50°F Entering Water	3.6 COP	
Ground Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		32°F Entering Water	3.1 COP	

1. Subchapter 13-3 contains a complete specification of the reference test procedure, including the referenced year version of the test procedure.
2. IPLVs and Part Load rating conditions are only applicable to equipment with capacity modulation.
3. Single-phase, air-cooled heat pumps <65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.
4. As granted by U.S. Department of Energy letter of exception specific to individual companies. SDHV products without a letter of exception shall have the same efficiency as air-cooled air-conditioners.

TABLE 13-407.ABC.3.2.1C
WATER CHILLING PACKAGES MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Air Cooled, with Condenser, Electrically Operated	All Capacities	95°F db Outdoor Air	2.80 COP (1.26 kw/ton) 3.05 IPLV (1.15 kw/ton)	ARI 550/590
Air Cooled, without Condenser, Electrically Operated	All Capacities	95°F db Outdoor Air	3.10 COP (1.13 kw/ton) 3.45 IPLV (1.02 kw/ton)	
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	All Capacities	85°F Cond 44°F Evap	4.20 COP (.84 kw/ton) 5.05 IPLV (.70 kw/ton)	ARI 550/590
Water Cooled, Electrically Operated, Positive Displacement (Rotary Screw and Scroll)	<150 tons	85°F Cond 44°F Evap	4.45 COP (.79 kw/ton) 5.20 IPLV (.68 kw/ton)	ARI 550/590
	≥150 tons and <300 tons	85°F Cond 44°F Evap	4.90 COP (.72 kw/ton) 5.60 IPLV (.63 kw/ton)	
	≥300 tons	85°F Cond 44°F Evap	5.50 COP (.64 kw/ton) 6.15 IPLV (.57 kw/ton)	
Water Cooled, Electrically Operated, Centrifugal	<150 tons	85°F Cond 44°F Evap	5.00 COP (.70 kw/ton) 5.25 IPLV (.67 kw/ton)	ARI 550/590
	≥150 tons and <300 tons	85°F Cond 44°F Evap	5.55 COP (.63 kw/ton) 5.90 IPLV (.60 kw/ton)	
	≥300 tons	85°F Cond 44°F Evap	6.10 COP (.58 kw/ton) 6.40 IPLV (.55 kw/ton)	
Air Cooled Absorption Single Effect	All Capacities		0.60 COP	ARI 560
Water Cooled Absorption Single Effect	All Capacities		0.70 COP	
Absorption Double Effect, Indirect-Fired	All Capacities		1.0 COP 1.05 IPLV	
Absorption Double Effect, Direct-Fired	All Capacities		1.0 COP 1.00 IPLV	

1. The chiller equipment requirements do not apply for chillers used in low-temperature applications where the design leaving fluid temperature is <40°F.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

TABLE 13-407.ABC.3.2.1D
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE-PACKAGE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS, AND ROOM AIR CONDITIONER HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
SPVAC (Cooling Mode)	All Capacities	95°F db/75°F wb Outdoor Air	8.6 EER	ARI 390
SPVHP (Cooling Mode)	All Capacities	95°F db/75°F wb Outdoor Air	8.6 EER	
SPVHP (Heating Mode)	All Capacities	47°F db/43°F wb Outdoor Air	2.7 COP	
PTAC (Cooling Mode), New Construction	7,000 ≥ Btu/h < 8,000	95°F db Outdoor Air [,Based on capacity at lower range using EER= 12.5 – (0.213 × Cap/1000)][4]	11.0 EER	ARI 310/380
	8,000 ≤ Btu/h < 9,000		10.8 EER	
	9,000 ≤ Btu/h < 10,000		10.6 EER	
	10,000 ≤ Btu/h < 11,000		10.4 EER	
	11,000 ≤ Btu/h < 12,000		10.2 EER	
	12,000 ≤ Btu/h < 13,000		9.9 EER	
	13,000 ≤ Btu/h < 14,000		9.7 EER	
	14,000 ≤ Btu/h < 15,000		9.5 EER	
	>15,000 Btu/h		9.3 EER	
PTAC (Cooling Mode), Replacements[2]	7,000 ≥ Btu/h < 8,000	95°F db Outdoor Air [,Based on capacity at lower range using EER= 10.9 – (0.213 × Cap/1000)][4]	9.4 EER	
	8,000 ≤ Btu/h < 9,000		9.2 EER	
	9,000 ≤ Btu/h < 10,000		9.0 EER	
	10,000 ≤ Btu/h < 11,000		8.8 EER	
	11,000 ≤ Btu/h < 12,000		8.6 EER	
	12,000 ≤ Btu/h < 13,000		8.3 EER	
	13,000 ≤ Btu/h < 14,000		8.1 EER	
	14,000 ≤ Btu/h < 15,000		7.9 EER	
	>15,000 Btu/h		7.7 EER	
PTHP (Cooling Mode), New Construction	7,000 ≥ Btu/h < 8,000	95°F db Outdoor Air [,Based on capacity at lower range using EER= 12.3 – (0.213 × Cap/1000)][4]	10.8 EER	
	8,000 ≤ Btu/h < 9,000		10.6 EER	
	9,000 ≤ Btu/h < 10,000		10.4 EER	
	10,000 ≤ Btu/h < 11,000		10.2 EER	
	11,000 ≤ Btu/h < 12,000		10.0 EER	
	12,000 ≤ Btu/h < 13,000		9.7 EER	
	13,000 ≤ Btu/h < 14,000		9.5 EER	
	14,000 ≤ Btu/h < 15,000		9.3 EER	
	>15,000 Btu/h		9.1 EER	
PTHP (Cooling Mode), Replacements[2]	7,000 ≥ Btu/h < 8,000	95°F db Outdoor Air [,Based on capacity at lower range using EER= 10.8 – (0.213 × Cap/1000)][4]	9.3 EER	
	8,000 ≤ Btu/h < 9,000		9.1 EER	
	9,000 ≤ Btu/h < 10,000		8.9 EER	
	10,000 ≤ Btu/h < 11,000		8.7 EER	
	11,000 ≤ Btu/h < 12,000		8.5 EER	
	12,000 ≤ Btu/h < 13,000		8.2 EER	
	13,000 ≤ Btu/h < 14,000		8.0 EER	
	14,000 ≤ Btu/h < 15,000		7.8 EER	
	>15,000 Btu/h		7.6 EER	
PTHP (Heating Mode), New Construction	7,000 ≥ Btu/h < 8,000	47°F db Outdoor Air [,Based on capacity at lower range using COP= 3.2 – (0.026 × Cap/1000)][4]	3.02 COP	
	8,000 ≤ Btu/h < 9,000		2.99 COP	
	9,000 ≤ Btu/h < 10,000		2.97 COP	
	10,000 ≤ Btu/h < 11,000		2.94 COP	
	11,000 ≤ Btu/h < 12,000		2.91 COP	
	12,000 ≤ Btu/h < 13,000		2.89 COP	
	13,000 ≤ Btu/h < 14,000		2.86 COP	
	14,000 ≤ Btu/h < 15,000		2.84 COP	
	>15,000 Btu/h		2.81 COP	

continued

TABLE 13-407.ABC.3.2.1D – continued

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
PTHP (Heating Mode), Replacements[3]	7,000 ≥ Btu/h < 8,000	47°F db Outdoor Air [Based on capacity at lower range using COP = 2.9 – (0.026 × Cap/1000)][4]	2.72 COP	ARI 310/380
	8,000 ≤ Btu/h < 9,000		2.69 COP	
	9,000 ≤ Btu/h < 10,000		2.67 COP	
	10,000 ≤ Btu/h < 11,000		2.64 COP	
	11,000 ≤ Btu/h < 12,000		2.61 COP	
	12,000 ≤ Btu/h < 13,000		2.59 COP	
	13,000 ≤ Btu/h < 14,000		2.56 COP	
	14,000 ≤ Btu/h < 15,000		2.54 COP	
	> 15,000 Btu/h		2.51 COP	
Room Air Conditioners with Louvered Sides	< 6,000 Btu/h		9.7 SEER	ANSI/AHAM RAC-1
	≥6,000<8,000 Btu/h		9.7 EER	
	≥ 8,000 < 14,000Btu/h		9.8 EER	
	≥ 14,000 < 20,000Btu/h		9.7 EER	
	≥ 20,000 Btu/h		8.5 EER	
Room Air Conditioners, without Louvered Sides	< 8,000 Btu/h		9.0 EER	
	≥ 8,000 Btu/h and <20,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps with Louvered Sides	< 20,000 Btu/h ≥ 20,000 Btu/h		9.0 EER 8.5 EER	
Room Air Conditioner Heat Pumps without Louvered Sides	< 14,000 Btu/h ≥ 14,000 Btu/h		8.5 EER 8.0 EER	
Room Air Conditioner, Casement only	All Capacities		8.7 EER	
Room Air Conditioner, Casement-Slider	All Capacities		9.5 EER	

1. See each subcategory for minimum efficiency equation.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches high and less than 42 inches wide.
4. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

TABLE 13-407.ABC.3.2.1G
PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Sub-Category or Rating Condition	Performance Required[1,2]	Test Procedure[3]
Propeller or Axial Fan Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F wb Outdoor Air	≥38.2 gpm/hp	CTI ATC-105
Centrifugal Fan Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F wb Outdoor Air	≥20.0 gpm/hp	CTI ATC-105
Air Cooled Condensers	All	125°F Condensing Temperature R-22 Test Fluid 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering db	≥176,000 Btu/h	ARI 460

1. For purposes of this table, cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power.
2. For purposes of this table, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.
3. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

TABLE 13-407.ABC.3.2.2H
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS <150 TONS
COP_{std} = 5.00; $IPLV_{std}$ = 5.25

Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT[1] (°F)	Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
			COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]
40	75	35	5.11	5.35	5.33	5.58	5.48	5.73	5.67	5.93	5.79	6.06	5.88	6.15
40	80	40	4.62	4.83	4.92	5.14	5.09	5.32	5.27	5.52	5.38	5.63	5.45	5.70
40	85	45	3.84	4.01	4.32	4.52	4.58	4.79	4.84	5.06	4.98	5.20	5.06	5.29
41	75	34	5.19	4.43	5.41	5.66	5.56	5.81	5.75	6.02	5.89	6.16	5.99	6.26
41	80	39	4.73	4.95	5.01	5.24	5.17	5.41	5.35	5.60	5.46	5.71	5.53	5.78
41	85	44	4.02	4.21	4.46	4.67	4.70	4.91	4.94	5.17	5.06	5.30	5.14	5.38
42	75	33	5.27	5.51	5.49	5.74	5.64	5.90	5.85	6.12	6.00	6.27	6.11	6.39
42	80	38	4.84	5.06	5.10	5.33	5.25	5.49	5.43	5.67	5.53	5.79	5.61	5.87
42	85	43	4.19	4.38	4.59	4.80	4.81	5.03	5.03	5.26	5.15	5.38	5.22	5.46
43	75	32	5.35	5.59	5.57	5.82	5.72	5.99	5.95	6.23	6.11	6.39	6.23	6.52
43	80	37	4.94	5.16	5.18	5.42	5.32	5.57	5.50	5.76	5.62	5.87	5.70	5.96
43	85	42	4.35	4.55	4.71	4.93	4.91	5.13	5.12	5.35	5.23	5.47	5.30	5.54
44	75	31	5.42	5.67	5.65	5.91	5.82	6.08	6.07	6.34	6.24	6.53	6.37	6.67
44	80	36	5.03	5.26	5.26	5.50	5.40	5.65	5.58	5.84	5.70	5.96	5.79	6.05
44	85	41	4.49	4.69	4.82	5.04	5.00	5.25	5.20	5.43	5.30	5.55	5.38	5.62
45	75	30	5.50	5.75	5.74	6.00	5.92	6.19	6.19	6.47	6.38	6.68	6.53	6.83
45	80	35	5.11	5.35	5.33	5.58	5.48	5.73	5.67	5.93	5.79	6.06	5.88	6.15
45	85	40	4.62	4.83	4.92	5.14	5.09	5.32	5.27	5.52	5.38	5.63	5.45	5.70
46	75	29	5.58	5.84	5.83	6.10	6.03	6.30	6.32	6.61	6.54	6.84	6.70	7.00
46	80	34	5.19	5.43	5.41	5.66	5.56	5.81	5.75	6.02	5.89	6.16	5.99	6.26
46	85	39	4.73	4.95	5.01	5.24	5.17	5.41	5.35	5.60	5.46	5.71	5.53	5.78
47	75	28	5.66	5.92	5.93	6.20	6.15	6.43	6.47	6.77	6.71	7.02	6.88	7.20
47	80	33	5.27	5.51	5.49	5.74	5.64	5.90	5.85	6.12	6.00	6.27	6.11	6.39
47	85	38	4.84	5.06	5.10	5.33	5.25	5.49	5.43	5.67	5.53	5.79	5.61	5.87
48	75	27	5.75	6.02	6.04	6.32	6.28	6.56	6.64	6.94	6.89	7.21	7.09	7.41
48	80	32	5.35	5.59	5.57	5.82	5.72	5.99	5.95	6.23	6.21	6.39	6.23	6.52
48	85	37	4.94	5.16	5.18	5.42	5.32	5.57	5.50	5.76	5.62	5.87	5.70	5.96
Condenser DT[2]			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: 1 Btu/h = .2931 W, °C=[(°F)-32]/1.8

1. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature.
2. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
3. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature, which is IPLV.

$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
Where X = Condenser DT + LIFT
$COP_{adj} = K_{adj} \times COP_{std}$

TABLE 13-407.ABC.3.2.2I
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS >150 TONS, <300 TONS
COP_{std} = 5.55; $IPLV_{std}$ = 5.90

Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT[1] (°F)	Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
			COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]
40	75	35	5.65	6.03	5.90	6.29	6.05	6.46	6.26	6.68	6.40	6.83	6.51	6.94
40	80	40	5.10	5.44	5.44	5.80	5.62	6.00	5.83	6.22	5.95	6.35	6.03	6.43
40	85	45	4.24	4.52	4.77	5.09	5.06	5.40	5.35	5.71	5.50	5.87	5.59	5.97
41	75	34	5.74	6.13	5.80	6.38	6.14	6.55	6.36	6.79	6.51	6.95	6.62	7.06
41	80	39	5.23	5.58	5.54	5.91	5.71	6.10	5.91	6.31	6.03	6.44	6.11	6.52
41	85	44	4.45	4.74	4.93	5.26	5.19	5.54	5.46	5.82	5.60	5.97	5.69	6.07
42	75	33	5.83	6.22	6.07	6.47	6.23	6.65	6.47	6.90	6.63	7.07	6.75	7.20
42	80	38	5.35	5.71	5.64	6.01	5.80	6.19	6.00	6.40	6.12	6.53	6.20	6.62
42	85	43	4.63	4.94	5.08	5.41	5.31	5.67	5.56	5.93	5.69	6.07	5.77	6.16
43	75	32	5.91	6.31	6.15	6.56	6.33b	6.75	6.58	7.02	6.76	7.21	6.89	7.35
43	80	37	5.46	5.82	5.73	6.11	5.89	6.28	6.08	6.49	6.21	6.62	6.30	6.72
43	85	42	4.81	5.13	5.21	5.55	5.42	5.79	5.66	6.03	5.78	6.16	5.86	6.25
44	75	31	6.00	6.40	6.24	6.66	6.43	6.86	6.71	7.15	6.90	7.36	7.05	7.52
44	80	36	5.56	5.93	5.81	6.20	5.97	6.37	6.17	6.58	6.30	6.72	6.40	6.82
44	85	41	4.96	5.29	5.33	5.68	5.55	5.90	5.74	6.13	5.86	6.26	5.94	6.34
45	75	30	6.08	6.49	6.34	6.76	6.54	6.98	6.84	7.30	7.06	7.53	7.22	7.70
45	80	35	5.65	6.03	5.90	6.29	6.05	6.46	6.26	6.68	6.40	6.83	6.51	6.94
45	85	40	5.10	5.44	5.44	5.80	5.62	6.00	5.83	6.22	5.95	6.35	6.03	6.43
46	75	29	6.17	6.58	6.44	6.87	6.66	7.11	6.99	7.46	7.23	7.71	7.409	7.90
46	80	34	5.74	6.13	5.80	6.38	6.14	6.55	6.36	6.79	6.51	6.95	6.62	7.06
46	85	39	5.23	5.58	5.54	5.91	5.71	6.10	5.91	6.31	6.03	6.44	6.11	6.52
47	75	28	6.26	6.68	6.56	6.99	6.79	7.24	7.16	7.63	7.42	7.91	7.61	8.11
47	80	33	5.83	6.21	6.07	6.47	6.23	6.64	6.47	6.90	6.63	7.07	6.75	7.20
47	85	38	5.35	5.70	5.64	6.01	5.80	6.19	6.00	6.40	6.12	6.52	6.20	6.61
48	75	27	6.36	6.78	6.68	7.12	6.94	7.40	7.34	7.82	7.62	8.13	7.83	8.35
48	80	32	5.91	6.30	6.15	6.56	6.33	6.75	6.58	7.02	6.76	7.21	6.89	7.35
48	85	37	5.46	5.82	5.73	6.10	5.89	6.28	6.08	6.49	6.21	6.62	6.30	6.71
Condenser DT[2]			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: 1 Btu/h = .2931 W, °C=[(°F)-32]/1.8

1. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature.
2. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
3. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature, which is IPLV.

$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
Where X = Condenser DT + LIFT
$COP_{adj} = K_{adj} \times COP_{std}$

TABLE 13-407.ABC.3.2.2J
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS > 300 TONS
COP_{std} = 6.10; $IPLV_{std}$ = 6.40

Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT[1] (°F)	Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
			COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]
40	75	35	6.23	6.55	6.50	6.83	6.68	7.01	6.91	7.26	7.06	7.42	7.17	7.54
40	80	40	5.63	5.91	6.00	6.30	6.20	6.52	6.43	6.76	6.56	6.89	6.65	6.98
40	85	45	4.68	4.91	5.26	5.53	5.58	5.86	5.90	6.20	6.07	6.37	6.17	6.48
41	75	34	6.33	6.65	6.60	6.93	6.77	7.12	7.02	7.37	7.18	7.55	7.30	7.67
41	80	39	5.77	6.06	6.11	6.42	6.30	6.62	6.52	6.85	6.65	6.99	6.74	7.08
41	85	44	4.90	5.15	5.44	5.71	5.72	6.01	6.02	6.33	6.17	6.49	6.27	6.59
42	75	33	6.43	6.75	6.69	7.03	6.87	7.22	7.13	7.49	7.31	7.68	7.44	7.82
42	80	38	5.90	6.20	6.21	6.53	6.40	6.72	6.61	6.95	6.75	7.09	6.84	7.19
42	85	43	5.11	5.37	5.60	5.88	5.86	6.16	6.13	6.44	6.28	6.59	6.37	6.69
43	75	32	6.52	6.85	6.79	7.13	6.98	7.33	7.26	7.63	7.45	7.83	7.60	7.98
43	80	37	6.02	6.32	6.31	6.63	6.49	6.82	6.71	7.05	6.85	7.19	6.94	7.30
43	85	42	5.30	5.57	5.74	6.03	5.98	6.28	6.24	6.55	6.37	6.70	6.46	6.79
44	75	31	6.61	6.95	6.89	7.23	7.09	7.45	7.40	7.77	7.61	8.00	7.77	8.16
44	80	36	6.13	6.44	6.41	6.73	6.58	6.92	6.81	7.15	6.95	7.30	7.05	7.41
44	85	41	5.57	5.75	5.87	6.17	6.10	6.40	6.33	6.66	6.47	6.79	6.55	6.89
45	75	30	6.71	7.05	6.99	7.35	7.21	7.58	7.55	7.93	7.78	8.18	7.96	8.36
45	80	35	6.23	6.55	6.50	6.83	6.68	7.01	6.91	7.23	7.06	7.42	7.17	7.54
45	85	40	5.63	5.91	6.00	6.30	6.20	6.52	6.43	6.76	6.56	6.89	6.65	6.98
46	75	29	6.80	7.15	7.11	7.47	7.35	7.72	7.71	8.10	7.97	8.37	8.16	8.58
46	80	34	6.33	6.65	6.60	6.93	6.77	7.12	7.02	7.37	7.18	7.55	7.30	7.67
46	85	39	5.77	6.06	6.11	6.42	6.30	6.62	6.52	6.85	6.65	6.99	6.74	7.08
47	75	28	6.91	7.26	7.23	7.60	7.49	7.87	7.89	8.29	8.18	8.59	8.39	8.82
47	80	33	6.43	6.75	6.69	7.03	6.87	7.22	7.13	7.49	7.31	7.68	7.44	7.82
47	85	38	5.90	6.20	6.21	6.53	6.40	6.72	6.61	6.95	6.75	7.09	6.84	7.19
48	75	27	7.01	7.37	7.36	7.74	7.65	8.04	8.09	8.50	8.41	8.83	8.64	9.08
48	80	32	6.52	6.85	6.79	7.13	6.98	7.33	7.26	7.63	7.45	7.83	7.60	7.98
48	85	37	6.02	6.32	6.31	6.63	6.49	6.82	6.71	7.05	6.85	7.19	6.94	7.30
Condenser DT[2]			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: 1 Btu/h = .2931 W, °C=[(°F)-32]/1.8

1. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature.
2. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
3. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature, which is IPLV.

$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
Where X = Condenser DT + LIFT
$COP_{adj} = K_{adj} \times COP_{std}$

a Radiant hydronic ceiling or floor panels (used for heating or cooling).

b. Combination or hybrid systems incorporating radiant heating (or cooling) panels.

c. Radiant heating (or cooling) panels used in conjunction with other systems such as variable air volume or thermal storage systems.

13-408.ABC.3.2.3 Heating systems having additional functions. Space heating equipment used to provide additional functions (e.g. service water heating) as part of a combination (integrated) system shall comply with minimum performance requirements for the appropriate space heating equipment category. Service water heating equipment used to provide additional functions (e.g. space heating) as part of a combination (integrated) system shall, as a minimum, meet the minimum performance requirements for water heating equipment in Section 13-412.ABC.

13-408.A Requirements specific to Method A. Heating system efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in buildings.

13-408.BC Prescriptive requirements specific to Methods B and C. Heating system minimum efficiency requirements for buildings complying by Methods B and C shall meet or exceed the appropriate code minimum for the equipment installed. See Tables 13-407.ABC.3.2.1B, 13-407.ABC.3.2.1D, and 13-408.ABC.3.2.1E through 13-408.ABC.3.2.1G.

SECTION 13-409
VENTILATION

13-409.ABC Mandatory requirements for Methods A, B and C.

13-409.ABC.1 Air quality. Sources of pollutants within the conditioned space shall be minimized or eliminated, if possible, in order to minimize the outside air intake required for dilution. Concentrated sources shall be controlled at the source by containment, local exhaust systems, or both.

13-409.ABC.1.1 Ventilation systems shall be designed to be capable of reducing the supply of outdoor air to the minimum ventilation rates required by section 6.1.3 of ASHRAE 62. Systems may be designed to supply outside air quantities exceeding minimum levels, but they shall be capable of operating at no more than minimum levels through the use of return ducts, manually or automatically operated control dampers, fan volume controls, or other devices.

Exception: Minimum outdoor air quantities may be greater if required to make up air exhausted for source control of contaminants or if required by process systems.

13-409.ABC.2 Building pressures. Mechanical systems shall be designed to assure that buildings are pressurized with respect to outdoors.

13-409.ABC.3 Ventilation system controls.

13-409.ABC.3.1 Stair and shaft vents. Stair and elevator shaft vents shall be equipped with motorized dampers that are capable of being automatically closed during normal building operation and are interlocked to open as required by fire and smoke detection systems.

TABLE 13-408.ABC.3.2.1E
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS. MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Warm Air Furnace, Gas-Fired	<225,000 Btu/h		78 percent AFUE or; 80 percent E_t[4]	DOE 10 CFR, Part 430 or ANSI Z 21.47
	≥225,000 Btu/h	Maximum Capacity[4]	80 percent E_c[3]	ANSI Z21.47
Warm Air Furnace, Oil-Fired	<225,000 Btu/h		78 percent AFUE or; 80 percent E_t[4]	DOE 10 CFR, Part 430 or UL 727
	≥225,000 Btu/h	Maximum Capacity[5]	81 percent E_t[6]	UL 727
Warm Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity[5]	80 percent E_c[7]	ANSI Z83.8
Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity[5]	80 percent E_c[7]	ANSI Z83.8
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity[5]	80 percent E_c[7]	UL 731

For SI: 1Btu/h = .0048 m3/kw, °C = [(°F) - 32]/1.8.

1. E_t = thermal efficiency. See test procedure for detailed discussion.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. E_c = combustion efficiency. Units must also include an IID, have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
4. Combination units not covered by NAECA (3 phase power or cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating.
5. Minimum and maximum ratings as provided for and allowed by the unit's controls.
6. E_t = thermal efficiency. Units must also include an IID, have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
7. E_c = combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

TABLE 13-408.ABC.3.2.1F
GAS- AND OIL-FIRED BOILERS
MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type[4]	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Boilers, Gas-Fired	<300,000 Btu/h	Hot water	80 percent AFUE	DOE 10 CFR Part 430
		Steam	75 percent AFUE	
	>300,000 Btu/h and ≤2,500,000	Maximum Capacity[3]	75 percent E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	80 percent E_c	
	>2,500,000 Btu/h[4]	Steam	80 percent E_c	
Boilers, Oil-Fired	<300,000 Btu/h		80 percent AFUE	DOE 10 CFR Part 430
	>300,000 Btu/h and ≤250,000,000 Btu/h	Maximum Capacity[3]	78 percent E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	83 percent E_c	
	>2,500,000 Btu/h[4]	Steam	83 percent E_c	
Oil-Fired (Residual)	>300,000 Btu/h and ≤250,000,000 Btu/h	Maximum Capacity[3]	78 percent E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	83 percent E_c	
	>2,500,000 Btu/h[4]	Steam	83 percent E_c	

For SI: 1Btu/h = .0048 m3/kw, °C = [(°F) - 32]/1.8.
1. E_t = thermal efficiency. See reference documents for detailed information.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. Minimum and maximum ratings as provided for and allowed by the unit's controls.

13-409.ABC.3.2 Gravity hoods, vents, and ventilators. All outdoor air supply and exhaust hoods, vents, and ventilators shall be equipped with motorized dampers that will automatically shut when the spaces served are not in use.

Exceptions:

1. Gravity (nonmotorized) dampers are acceptable in buildings less than three stories in height above grade and for buildings of any height located in climates with less than 2,700 HDD 65.
2. Ventilation systems serving unconditioned spaces.

13-409.ABC.3.3 Shutoff damper controls. Both outdoor air supply and exhaust systems shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use. Ventilation outside air dampers shall be capable of automatically shutting off during preoccupancy building warmup, cooldown, and setback, except when ventilation reduces energy costs (e.g., night purge) or when ventilation must be supplied to meet code requirements.

Exceptions:

1. Gravity (nonmotorized) dampers are acceptable in building exhaust air systems.
2. Gravity (nonmotorized) dampers are acceptable in systems with a design outside air intake or exhaust capacity of 300 cfm (.14 m^3/s) or less.

13-409.ABC.3.3.1 Damper leakage. Where outdoor air supply and exhaust air dampers are required by Section 13-409.ABC.3, they shall have a maximum leakage rate at 1 inches w.g. of 4 cfm per square foot of damper area for motorized dampers when tested in accordance with AMCA Standard 500 as indicated in Table 13-409.ABC.3.3.1.

TABLE 13-409.ABC.3.3.1
MAXIMUM DAMPER LEAKAGE

Maximum Damper Leakage at 1.0 inches w.g. cfm per ft^2 of damper area	
Motorized	Nonmotorized
4	Not allowed[a]

13-409.ABC.3.4 Ventilation controls for high-occupancy areas. Systems with design outside air capacities greater than 3,000 cfm (1.4 m^3/s) serving areas having an average design occupancy density exceeding 100 people per 1,000 square feet (93 m^2) shall include means to automatically reduce outside air intake below design rates when spaces are partially occupied. Ventilation controls shall be in compliance with ASHRAE 62 and local standards.

Exception: Systems with heat recovery complying with Section 13-407.ABC.3.5.

13-409.ABC.3.5 Exhaust hoods.

13-409.ABC.3.5.1 Nonresidential kitchen spaces. Nonresidential kitchen space and areas in dining rooms or open malls where a kitchen exhaust hood is

required by NFPA 96 shall comply with the following requirements:

1. Be designed with an exhaust air and make up air balance such that the space is never under a positive pressure, and never under a negative pressure exceeding 0.02 inch w.g. relative to all indoor spaces surrounding the kitchen space, during all cooking hours.
2. All exhaust and makeup air system components (fans, dampers, etc.) shall be interlocked in such a way that the balance prescribed in Item 1 above is maintained throughout all cooking hours, and all variations of cooking operations.

13-409.ABCD.3.5.2 Fume hoods. Buildings with fume hood systems having a total exhaust rate greater than 15,000 cfm (7 m^3/s) shall include at least one of the following features:

1. Variable air volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values.
2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (-17°C) below room set point, cooled to no cooler than 3°F (-16°C) above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Heat recovery systems to precondition makeup air from fume hood exhaust in accordance with Section 13-407.ABC.3.5 (Exhaust Air Energy Recovery) without using any exception.

SECTION 13-410
AIR DISTRIBUTION SYSTEMS

13-410.ABC Mandatory requirements for Methods A, B and C.

13-410.ABC.1 Sizing and design criteria.

13-410.ABC.1.1 Air system design and control. HVAC systems having a total fan system power exceeding 5 hp shall meet the provisions of Table 13-410.ABC.1.1.1 and Section 13-410.ABC.1.1.2 unless otherwise noted.

13-410.ABC.1.1.1 Fan power limitation. Fan power shall be limited by the following:

1. The ratio of the fan system power to the supply fan airflow rate (main fan) of each HVAC system at design conditions shall not exceed the allowable fan system power shown in Table 13-410.ABC.1.1.1.
2. Where air systems require air treatment or filtering systems with pressure drops over 1 inches w.c. when filters are clean, or heat recovery coils or devices, or direct evaporative humidifiers/coolers, or other devices to serve process loads in the airstream, the allowable fan system power may be adjusted using the pressure credit in the allowable fan system equation below.
3. If the temperature difference between design room temperature and supply air temperature at cooling design conditions that is used to calculate design zone supply airflow is larger than 20°F (-7°C), the allowable fan system power may be adjusted using the temperature ratio in the Allowable fan system power equation below.

TABLE 13-410.ABC.1.1.1
FAN POWER LIMITATION

	Allowable Nameplate Motor Power	
Supply Air Volume	Constant Volume	Variable Volume
<20,000 cfm	1.2 hp/1000 cfm	1.7 hp/1000 cfm
≥20,000 cfm	1.1 hp/1000 cfm	1.5 hp/1000 cfm

For SI: 1Btu/h = .0048 m^3/kw, °C = [(°F) - 32]/1.8.

Allowable fan system power = [fan power limitation ×· (Temperature ratio) + Pressure credit + Relief fan credit]

Where:

Fan power limitation = Table 13-410.ABC.1.1.1 Value × $CFM_n/1000$
Temperature ratio = $(T_{t\text{-}stat} - T_S) / 20$
Pressure credit (hp) = Sum of $[CFM_n \cdot (SP_n - 1.0) / 3718]$ + Sum of $[CFM_{HR} \cdot SP_{HR}/3718]$
Relief fan credit HP (kW) = F_R HP (kW) × $[1 - (CFM_{RF} / CFM_n)]$

CFM_n = supply air volume of the unit with the filtering system (cfm)

CFM_{HR} = supply air volume of heat recovery coils or direct evaporative humidified/ cooler (cfm)

CFM_{RF} = relief fan air volume at normal cooling design operation

SP_n = air pressure drop of the filtering system when filters are clean (inches w.g.)

SP_{HR} = air pressure drop of heat recovery coils or direct evaporative humidifier/cooler (inches w.g.).

$T_{t\text{-}stat}$ = room thermostat set point

T_S = design supply air temperature for the zone in which the thermostat is located

F_R = name plate rating of the relief fan in hp

13-410.ABC.1.1.2 Variable air volume (VAV) fan control. (Including systems using series fan power boxes).

13-410.ABC.1.1.2.1 Part-load fan power limitation. Individual VAV fans with motors 15 hp (11 kW) and larger shall meet one of the following:

1. The fan shall be driven by a mechanical or electrical variable-speed drive.

2. The fan shall be a vane-axial fan with variable-pitch blades.
3. The fan shall have other controls and devices that will result in fan motor demand of no more than 30 percent of design wattage at 50 percent of design air volume when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data

13-410.ABC.1.1.2.2 Static pressure sensor location. Static pressure sensors used to control variable air volume fans shall be placed in a position such that the controller set point is no greater than one-third the total design fan static pressure, except for systems with zone reset control complying with Section 13-410.ABC.1.1.2.3. If this results in the sensor being located downstream of major duct splits, multiple sensors shall be installed in each major branch to ensure that static pressure can be maintained in each.

13-410.ABC.1.1.2.3 Set point reset. For systems with direct digital control of individual zone boxes reporting to the central control panel, static pressure set point shall be reset based on the zone requiring the most pressure; i.e., the set point is reset lower until one zone damper is nearly wide open.

13-410.ABC.1.2 Duct sizing and design. Duct systems shall be sized and designed through the use of ASHRAE, ACCA or other nationally recognized design procedure.

13-410.ABC.2 Air distribution system insulation. All air distribution system components which move or contain conditioned air including, but not limited to, air filter enclosures, air ducts and plenums that are located in or on buildings shall be thermally insulated in accordance with the criteria of Sections 13-410.ABC.2.1 through 13-410.ABC.2.5.

13-410.ABC.2.1 General. Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind, but not limited to the following:

1. Insulation exposed to weather shall be suitable for outdoor service, e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
2. Insulation covering chilled water piping, refrigerant suction piping, or cooling ducts located outside the conditioned space shall include a vapor retardant located outside the insulation (unless the insulation is inherently vapor retardant), all penetrations and joints of which shall be sealed.

13-410.ABC.2.2 Insulation required. All supply and return ducts and plenums installed as part of an HVAC air distribution system shall be thermally insulated in accordance with Table 13-410.ABC.2.2.

Exceptions:

1. Factory-installed plenums, casings, or ductwork furnished as a part of HVAC equipment tested and rated in accordance with Sections 13-407.ABC.3.2 and 13-408.ABC.3.2.1.
2. Ducts or plenums located in heated spaces, semiheated spaces, or cooled spaces.
3. For runouts less than 10 feet (3048 mm) in length to air terminals or air outlets, the rated *R*-value of insulation need not exceed *R*-4.2.
4. Backs of air outlets and outlet plenums exposed to unconditioned or indirectly conditioned spaces with face areas exceeding 5 square feet (.46 m^2) need not exceed *R*-2; those 5 square feet (.46 m^2) or smaller need not be insulated.
5. Return air ducts meeting all the requirements of Section 13-410.ABC.3.6 for building cavities which will be used as return air plenums.

TABLE 13-410.ABC.2.2
MINIMUM DUCT INSULATION R-VALUES,
Combined Heating and Cooling Supply and Return Ducts

Location	Supply Duct	Return Duct
Exterior of building	R-6	R-4.2
Ventilated attic	R-6	R-4.2
Unvented attic above insulated ceiling	R-6[3]	R-4.2
Unvented attic with roof insulation	R-4.2	None
Unconditioned spaces[1]	None	None
Indirectly conditioned spaces[2]	None	None
Conditioned spaces	None	None
Buried	R-4.2	None

1. Includes crawl spaces, both ventilated and nonventilated.
2. Includes return air plenums with or without exposed roofs above.
3. R-8 duct insulation is required for Miami-Dade, Broward and Monroe Counties.

13-410.ABC.2.3 *R*-value determination. All duct insulation and factory-made ducts shall be labeled with *R*-values based on flat sections of insulation only at installed thickness and excluding any air film resistance. The thermal resistance (R) shall be determined using the relationship R=t/k where t (inches) is the installed thickness and k (Btu-in/hr·ft²°F) is the measured apparent thermal conductivity at 75°F (24°C) mean temperature and at installed thickness tested in accordance with ASTM C 518 or ASTM C 177.

The installed thickness of duct insulation used to calculate *R*-values shall be determined as follows:

1. Duct board, duct liner and factory-made rigid ducts not normally subjected to compression shall use the nominal insulation thickness.
2. Duct wrap shall have an assumed installed thickness of 75 percent of nominal thickness (25-percent compression).

3. Factory-made flexible air ducts shall have the installed thickness and calculated *R*-values determined in accordance with Paragraph 3.4, of the Air Diffusion Council Standard, *Flexible Duct Performance & Installation Standards.*

13-410.ABC.2.4 Condensation control. Additional insulation with vapor barrier shall be provided where the minimum duct insulation requirements of 13-410.ABC.2.2 are determined to be insufficient to prevent condensation.

13-410.ABC.2.5 Fibrous glass duct liner. Fibrous glass duct liner shall be fabricated and installed in accordance with the provisions of the NAIMA *Fibrous Glass Duct Liner Standard.*

13-410.ABC.3 Air distribution system construction and installation. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability. All transverse joints, longitudinal seams and fitting connections shall be securely fastened and sealed in accordance with the applicable standards of this section.

13-410.ABC.3.0 General. All enclosures which form the primary air containment passageways for air distribution systems shall be considered ducts or plenum chambers and shall be constructed and sealed in accordance with the applicable criteria of this section.

13-410.ABC.3.0.1 Mechanical fastening. All joints between sections of air ducts and plenums, between intermediate and terminal fittings and other components of the air distribution system, and between subsections of these components shall be mechanically fastened to secure the sections independently of the closure system(s).

13-410.ABC.3.0.2 Sealing. Air distribution system components shall be sealed with approved closure systems.

13-410.ABC.3.0.3 Space provided. Sufficient space shall be provided adjacent to all mechanical components located in or forming a part of the air distribution system to assure adequate access for (1) construction and sealing in accordance with the requirements of Section 13-410.ABC.3 of this code, (2) inspection and (3) cleaning and maintenance. A minimum of 4 inches (102 mm) is considered sufficient space around air handling units.

Exception: Retrofit or replacement units not part of a renovation are exempt from the minimum clearance requirement.

13-410.ABC.3.0.4 Product application. Closure products shall be applied to the air barriers of air distribution system components being joined in order to form a continuous barrier or they may be applied in accordance with the manufacturer's instructions or appropriate industry installation standard where more restrictive.

13-410.ABC.3.0.5 Surface preparation. The surfaces upon which closure products are to be applied shall be clean and dry in accordance with the manufacturer's installation instructions.

13-410.ABC.3.0.6 Approved mechanical attachments. Approved mechanical attachments for air distribution system components include screws, rivets, welds, interlocking joints crimped and rolled, staples, twist in (screw attachment), and compression systems created by bend tabs or screws tabs and flanges or by clinching straps. Mechanical attachments shall be selected to be appropriate to the duct system type.

13-410.ABC.3.0.7 Approved closure systems. The following closure systems and materials are approved for air distribution construction and sealing for the applications and pressure classes prescribed in Sections 13-410.ABC.3.1 through 13-410.ABC.3.8:

1. Metal closures.
   a. Welds applied continuously along metal seams or joints through which air could leak.
   b. Longitudinal grooved metal seams and snaplock seams that are rolled and crimped by the manufacturer.
2. Gasketing, which achieves a 25/50 flame spread/smoke density development rating under ASTM E 84 or UL 723, provided that it is used only between mated surfaces which are mechanically fastened with sufficient force to compress the gasket and to fill all voids and cracks through which air leakage would otherwise occur.
3. Mastics closures. Mastics shall be placed over the entire joint between mated surfaces. Mastics shall not be diluted. Approved mastics include the following:
   a. Mastic or mastic-plus-embedded fabric systems applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part III.
   b. Mastic or mastic-plus-embedded fabric systems applied to nonmetal flexible duct that are listed and labeled in accordance with UL 181B, Part II.
   c. Mastic ribbons, which achieve a 25/50 flame spread/smoke-density-development rating under ASTM E 84 or UL 723, provided that they may be used only in flange-joints and lap-joints, such that the mastic resides between two parallel surfaces of the air barrier and that those surfaces are mechanically fastened.
4. Tapes. Tapes shall be applied such that they extend not less than 1 inch (25 mm) onto each of the mated surfaces and shall totally cover the joint. When used on rectangular ducts, tapes shall be used only on joints between parallel rigid surfaces and on right angle joints. Approved tapes include the following:
   a. Pressure-sensitive tapes.

1) Pressure-sensitive tapes applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part I.
2) Pressure-sensitive tapes applied to nonmetal flexible duct that are listed and labeled in accordance with UL 181B, Part I

b. Heat-activated tapes applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part II.

5. Aerosol sealant. Such sealants shall be installed by manufacturer-certified installers following manufacturer instructions and shall achieve 25/50 flame spread/smoke- density-development ratings under ASTM E 84 or UL 723.

13-410.ABC.3.1 Metal duct, rigid and flexible. All transverse joints, longitudinal seams and duct wall penetration of ducts and joints with other air distribution system components shall be mechanically attached and sealed using approved closure systems for that pressure class as specified in Section 13-410.ABC.3.1.1 or Section 13-410.ABC.3.1.2.

13-410.ABC.3.1.1 Pressures less than 1 inch water gauge, approved closure systems. The following closure systems are approved for rigid metal duct designed to be operated at pressures less than 1 inch w.g. when they conform to the approved closure and mechanical attachment requirements of Section 13-410.ABC.3.0:

1. Continuous welds.
2. Snaplock seams and grooved, standing, double-corner, single-corner and Pittsburgh-lock seams, and all other rolled mechanical seams.
3. Mastic, mastic-plus-embedded fabric or mastic ribbons.
4. Gaskets.
5. Pressure-sensitive tape.
6. Aerosol sealant.

13-410.ABC.3.1.2 Pressures 1-inch water gauge or greater, approved closure systems. The following closure systems are approved for rigid metal duct designed to be operated at pressures 1-inch w.g. or greater when they conform to the approved closure and mechanical attachment requirements of Section 13-410.ABC.3.0:

1. Continuous welds.
2. Mastic, mastic-plus-embedded fabric systems, or mastic ribbons.
3. Gaskets.

13-410.ABC.3.1.3 High pressure duct systems. High pressure duct systems designed to operate at pressures greater than 3-inch water gauge (4-inch water gauge pressure class), shall be tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual*. The tested duct leakage class, at a test pressure equal to the design duct pressure class rating, shall be equal to or less than Leakage Class 6. Leakage testing may be limited to representative sections of the duct system but in no case shall such tested sections include less than 25 percent of the total installed duct area for the designated pressure class.

13-410.ABC.3.2 Fibrous glass duct, rigid. All rigid fibrous glass ducts and plenums shall be constructed and erected in accordance with the provisions of the NAIMA *Fibrous Glass Duct Construction Standards*.

All joints, seams and duct wall penetrations including, but not limited to, the joints between sections of duct and the joints between duct and other distribution system components shall be mechanically attached and sealed using approved closure systems as specified in Section 13-410.ABC.3.2.1.

13-410.ABC.3.2.1 Approved closure systems. The following closure systems are approved for rigid fibrous glass duct when they meet the approved closure and mechanical attachment requirements of Section 13-410.ABC.3.0:

1. Heat-activated tapes.
2. Pressure-sensitive tapes.
3. Mastics or mastic-plus-embedded fabric systems.

13-410.ABC.3.2.2 Mechanical fastening. Attachments of ductwork to air handling equipment shall be by mechanical fasteners. Where access is limited, two fasteners on one side shall be acceptable when installed in accordance with Section 13-410.ABC.3.0.6.

13-410.ABC.3.3 Flexible duct systems, nonmetal. Flexible nonmetal ducts shall be joined to all other air distribution system components by either terminal or intermediate fittings. All duct collar fittings shall have a minimum $^5/_8$-inch (16 mm) integral flange for sealing to other component and a minimum 3-inch (76 mm) shaft for insertion into the inner duct core.

Flexible ducts having porous inner cores shall not be used.

Exception: Ducts having a nonporous liner between the porous inner core and the outer jacket. Fastening and sealing requirements shall be applied to such intermediate liners.

All joints of flexible ducts to fittings and fittings to other air distribution system components shall be mechanically attached and sealed as specified in Sections 13-410.ABC.3.3.1 through 13-410.ABC.3.3.6.

13-410.ABC.3.3.1 Duct core to duct fitting, mechanical attachment. The reinforced core shall be mechanically attached to the duct fitting by a drawband installed directly over the wire-reinforced core and the duct fitting. The duct fitting shall extend a minimum of 2 inches (51 mm) into each section of duct core. When the flexible duct is larger than 12 inches (305 mm) in diameter or the design pressure exceeds 1 inch water gauge, the drawband shall be se-

cured by a raised bead or indented groove on the fitting.

13-410.ABC.3.3.2 Duct core to duct fitting, approved closure systems. The reinforced core shall be sealed to the duct fitting using one of the following sealing materials which conforms to the approved closure and mechanical attachment requirements of Section 13-410.ABC.3.0:

1. Gasketing.
2. Mastic, mastic-plus-embedded fabric systems, or mastic ribbons.
3. Pressure-sensitive tape.
4. Aerosol sealants, provided that their use is consistent with UL 181.

13-410.ABC.3.3.3 Duct outer jacket to duct collar fitting. The outer jacket of a flexible duct section shall be secured at the juncture of the air distribution system component and intermediate or terminal fitting in such a way as to prevent excess condensation. The outer jacket of a flexible duct section shall not be interposed between the flange of the duct collar fitting and the flexible duct, rigid fibrous glass duct board, or sheet metal to which it is mated.

13-410.ABC.3.3.4 Duct collar fittings to rigid duct, mechanical attachment. The duct collar fitting shall be mechanically attached to the rigid duct board or sheet metal by appropriate mechanical fasteners, either screws, spin-in flanges, or dovetail flanges.

13-410.ABC.3.3.5 Duct collar fitting to rigid duct, approved closure systems. The duct collar fitting's integral flange shall be sealed to the rigid duct board or sheet metal using one of the following closure systems/materials which conforms to the approved closure and mechanical attachment standards of Sections 13-410.ABC.3.0:

1. Gasketing.
2. Mastic or mastic-plus-embedded fabric.
3. Mastic ribbons when used to attach a duct collar to sheet metal.
4. Pressure-sensitive tape.
5. Aerosol sealants, provided that their use is consistent with UL 181.

13-410.ABC.3.3.6 Flexible duct installation and support. Flexible ducts shall be configured and supported so as to prevent the use of excess duct material, prevent duct dislocation or damage, and prevent constriction of the duct below the rated duct diameter in accordance with the following requirements:

1. Ducts shall be installed fully extended. The total extended length of duct material shall not exceed 5 percent of the minimum required length for that run.
2. Bends shall maintain a center line radius of not less than one duct diameter.
3. Terminal devices shall be supported independently of the flexible duct.
4. Horizontal duct shall be supported at intervals not greater than 5 feet (1524 mm). Duct sag between supports shall not exceed $^1/_2$ inch (12.7 mm) per foot of length. Supports shall be provided within $1^1/_2$ feet (457 mm) of intermediate fittings and between intermediate fittings and bends. Ceiling joists and rigid duct or equipment may be considered to be supports.
5. Vertical duct shall be stabilized with support straps at intervals not greater than 6 feet (1829 mm).
6. Hangers, saddles and other supports shall meet the duct manufacturer's recommendations and shall be of sufficient width to prevent restriction of the internal duct diameter. In no case shall the material supporting flexible duct that is in direct contact with it be less than $1^1/_2$ inches (38 mm).

13-410.ABC.3.4 Terminal and intermediate fittings. All seams and joints in terminal and intermediate fittings, between fitting subsections and between fittings and other air distribution system components or building components shall be mechanically attached and sealed using approved closure systems for that joining application as specified in Section 13-410.ABC.3.4.1 or Section 13-410.ABC.3.4.2.

13-410.ABC.3.4.1 Fittings and joints between dissimilar duct types, approved closure systems. Approved closure systems shall be as designated by air distribution system component material type in Section 13-410.ABC.3.

Exception: When the components of a joint are fibrous glass duct board and metal duct, including collar fittings and metal equipment housings, the closure systems approved for fibrous glass duct shall be used.

13-410.ABC.3.4.2 Terminal fittings and air ducts to building envelope components, approved closure systems. Terminal fittings and air ducts which penetrate the building envelope shall be mechanically attached to the structure and sealed to the envelope component penetrated and shall use one of the following closure systems/materials which conform to the approved closure and mechanical application requirements of Section 13-410.ABC.3.0:

1. Mastics or mastic-plus-embedded fabrics.
2. Gaskets used in terminal fitting/grille assemblies which compress the gasket material between the fitting and the wall, ceiling or floor sheathing.

13-410.ABC.3.5 Air-handling units. All air-handling units shall be mechanically attached to other air distribution system components. Air-handling units located outside the conditioned space shall be sealed using approved closure systems conforming to the approved

closure and mechanical application requirements of Section 13-410.ABC.3.1.

13-410.ABC.3.5.1 Approved closure systems. Systems conforming to the product and application standards of Section 13-410.ABC.3.0 may be used when sealing air handling units.

13-410.ABC.3.5.2 Air-handling units. Air-handling units shall not be installed in attics (see definition of "Attic" in Section 13-202).

13-410.ABC.3.6 Cavities of the building structure. Cavities in framed spaces, such as dropped soffits and walls, shall not be used to deliver air from or return air to the conditioning system unless they contain an air duct insert which is insulated in accordance with Section 13-410.ABC.2 and constructed and sealed in accordance with the requirements of Section 13-410.ABC.3 appropriate for the duct materials used.

Exception: Return air plenums.

Cavities designed for air transport such as mechanical closets, chases, air shafts, etc. shall be lined with an air barrier and sealed in accordance with Section 13-410.ABC.3.7 and shall be insulated in accordance with Section 13-410.ABC.2.

Building cavities which will be used as return air plenums shall be lined with a continuous air barrier made of durable nonporous materials. All penetrations to the air barrier shall be sealed with a suitable long-life mastic material.

Exception: Surfaces between the plenum and conditioned spaces from which the return/mixed air is drawn.

Building cavities beneath a roof deck that will be used as return air plenums shall have an insulated roof with insulation having an *R*-value of at least R-19.

13-410.ABC.3.7 Mechanical closets. The interior surfaces of mechanical closets shall be sheathed with a continuous air barrier as specified in Section 13-410.ABC.3.7.1 and shall be sealed with approved closure systems as specified in Section 13-410.ABC.3.7.2. All joints shall be sealed between air barrier segments and between the air barriers of walls and those of the ceiling, floor and door framing. All penetrations of the air barrier including but not limited to those by air ducts, service lines, refrigerant lines, electrical wiring, and condensate drain lines shall be sealed to the air barrier with approved closure systems.

Exception: Air passageways into the closet from conditioned space that are specifically designed for return air flow.

Through-wall, through-floor and through-ceiling air passageways into the closet shall be framed and sealed to form an airtight passageway using approved air duct materials and approved closure systems.

Duct penetrations through any part of the ceiling, walls or floor of a mechanical closet shall have sufficient space between surrounding ceiling, walls or floor and any duct or plenum penetration to allow for sealing of the penetration and inspection of the seal.

Clothes washers, clothes dryers, combustion water heaters and atmospheric combustion furnaces shall not be located in mechanical closets used as return air plenums.

13-410.ABC.3.7.1 Approved air barriers. The following air barriers are approved for use in mechanical closets:

1. One-half inch (12.7 mm) thick or greater gypsum wallboard;
2. Other panelized materials having inward facing surfaces with an air porosity no greater than that of a duct product meeting Section 22 of UL 181 which are sealed on all interior surfaces to create a continuous air barrier.

13-410.ABC.3.7.2 Approved closure systems. The following closure systems are approved for use in mechanical closets:

1. Gypsum wallboard joint compound over taped joints between gypsum wallboard panels.
2. Sealants complying with the product and application standards of Section 13-410.ABC.3.2.1 for fibrous glass ductboard;
3. A suitable long-life caulk or mastic compliant with the locally adopted mechanical code for all applications.

13-410.ABC.3.8 Enclosed support platforms. Enclosed support platforms located between the return air inlet(s) from conditioned space and the inlet of the air handling unit or furnace, shall contain a duct section constructed entirely of rigid metal, rigid fibrous glass duct board, or flexible duct which is constructed and sealed according to the respective requirements of Section 13-410.ABC.3 and insulated according to the requirements of Section 13-410.ABC.2.

The duct section shall be designed and constructed so that no portion of the building structure, including adjoining walls, floors and ceilings, shall be in contact with the return air stream or function as a component of this duct section.

The duct section shall not be penetrated by a refrigerant line chase, refrigerant line, wiring, pipe or any object other than a component of the air distribution system.

Through-wall, through-floor and through-ceiling air passageways into the duct section shall contain a branch duct which is fabricated of rigid fibrous glass duct board or rigid metal and which extends to and is sealed to both the duct section and the grille side wall surface. The branch duct shall be fabricated and attached to the duct insert in accordance with Section 13-410.ABC.3.2 or Section 13-410.ABC.3.1 for the duct type used.

13-410.ABC.4 Air distribution system testing, adjusting, and balancing.

13-410.ABC.4.1 Duct leakage tests. Air distribution systems shall be tested, adjusted, and balanced by an engineer licensed in this state or a company or individual

holding a current certification from a recognized testing and balancing organization.

Exceptions:

1. Buildings with cooling or heating system capacities of 15 tons or less per system may be tested and balanced by a mechanical contractor licensed to design and install such system(s).
2. Buildings with cooling or heating system capacities of 65,000 Btu/h or less per system are exempt from the requirements of this section.

13-410.ABC.4.2 General. Construction documents shall require that all HVAC systems be balanced in accordance with generally accepted engineering standards. Construction documents shall require that a written balance report be provided to the owner or the designated representative of the building owner for HVAC systems serving zones with a total conditioned area exceeding 5,000 square feet (465 m^2).

13-410.ABC.4.3 Air system balancing shall be accomplished in a manner to first minimize throttling losses, then fan speed shall be adjusted to meet design flow conditions. Balancing procedures shall be in accordance with the National Environmental Balancing Bureau (NEBB) Procedural Standards, the Associated Air Balance Council (AABC) National Standards, or equivalent procedures.

Exception: Damper throttling may be used for air system balancing with fan motors of 1 hp or less, or if throttling results in no greater than $^1/_3$ hp fan horsepower draw above that required if the fan speed were adjusted.

NOTES:

1. Building envelope pressurization should be either neutral or positive to prevent infiltration of excess latent load.
2. Commercial kitchen hood exhaust cfm should be sized to prevent depressurization (see Section 13-409.ABC.2 and NFPA 96).

13-410.A Requirements specific to Method A. Air distribution system efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in buildings.

SECTION 13-411
PUMPS AND PIPING

13-411.ABC Mandatory requirements for Methods A, B and C.

13-411.ABC.1 Hydronic system design and control. HVAC hydronic systems having a total pump system power exceeding 10 hp shall meet provisions of Sections 13-411.ABC.1.1 through 13-411.ABC.1.4.

13-411.ABC.1.1 Hydronic variable flow systems. HVAC pumping systems that include control valves designed to modulate or step open and close as a function of load shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to 50 percent or less of the design flow rate. Individual pumps serving variable flow systems having a pump head exceeding 100 feet (30 480 mm) and motor exceeding 50 hp shall have controls and/or devices (such as variable speed control) that will result in pump motor demand of no more than 30 percent of design wattage at 50 percent of design water flow. The controls or devices shall be controlled as a function of desired flow or to maintain a minimum required differential pressure. Differential pressure shall be measured at or near the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.

Exceptions:

1. Systems where the minimum flow is less than the minimum flow required by the equipment manufacturer for the proper operation of equipment served by the system, such as chillers, and where total pump system power is 75 hp or less.
2. Systems that include no more than three control valves.

13-411.ABC.1.2 Pump isolation. When a chilled water plant includes more than one chiller, provisions shall be made so that the flow in the chiller plant can be automatically reduced, correspondingly, when a chiller is shut down. Chillers referred to in this section, piped in series for the purpose of increased temperature differential, shall be considered as one chiller. When a boiler plant includes more than one boiler, provisions shall be made so that the flow in the boiler plant can be automatically reduced, correspondingly, when a boiler is shut down.

13-411.ABC.1.3 Chilled and hot water temperature reset controls. Chilled and hot water systems with a design capacity exceeding 300,000 Btu/h supplying chilled or heated water (or both) to comfort conditioning systems shall include controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outside air temperature.

Exceptions:

1. Where the supply temperature reset controls cannot be implemented without causing improper operation of heating, cooling, humidifying, or dehumidifying systems.
2. Hydronic systems, such as those required by Section 13-411.ABC.1.1 that use variable flow to reduce pumping energy.

13-411.ABC.1.4 Hydronic (water loop) heat pump systems. Each hydronic heat pump shall have a two-position automatic valve interlocked to shut off water flow when the compressor is off.

13-411.ABC.2 Piping insulation. Piping shall be thermally insulated in accordance with Table 13-411.ABC.2

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with Sections 13-407.ABC.3.2 and 13-408.ABC.3.2.1.
2. Piping that conveys fluids having a design operating temperature range between 60°F and 105°F (16°C and 41°C), inclusive.
3. Piping that conveys fluids that have not been heated or cooled through the use of nonrenewable energy (such as roof and condensate drains, domestic cold water supply, natural gas piping, or refrigerant liquid piping) or where heat gain or heat loss will not increase energy usage.
4. Hot water piping between the shutoff valve and the coil, not exceeding 4 feet (1219 mm) in length, when located in conditioned spaces.
5. Pipe unions in heating systems (steam, steam condensate, and hot water).

13-411.ABC.3 Hydronic system testing, adjusting, and balancing. Hydronic systems shall be tested, adjusted and balanced by a company holding a current certification from a nationally recognized testing and balancing organization.

SECTION 13-412
WATER HEATING SYSTEMS

13-412.ABC Mandatory requirements for Methods A, B and C.

13-412.ABC.1 Water heater sizing and design. Service water heating system design loads for the purpose of sizing systems and equipment shall be determined in accordance with manufacturers' published sizing guidelines or generally accepted engineering standards and handbooks acceptable to the adopting authority(e.g., ASHRAE *Handbook—HVAC Applications*).

13-412.ABC.2 Service water heating system controls.

13-412.ABC.2.1 Temperature controls. Temperature controls shall be provided that allow for storage temperature adjustment from 120°F (49°C)or lower to a maximum temperature compatible with the intended use.

Exception: When the manufacturer's installation instructions specify a higher minimum thermostat setting to minimize condensation and resulting corrosion.

13-412.ABC.2.2 Temperature maintenance controls. Systems designed to maintain usage temperatures in hot water pipes, such as recirculating hot water systems or heat trace, shall be equipped with automatic time switches or other controls that can be set to switch off the usage temperature maintenance system during extended periods when hot water is not required.

13-412.ABC.2.3 Circulating pump controls. When used to maintain storage tank water temperature, recirculating pumps shall be equipped with controls limiting operation to a period from the start of the heating cycle to a maximum of 5 minutes after the end of the heating cycle.

13-412.ABC.2.4 Heat traps. Vertical pipe risers serving storage water heaters and storage tanks not having integral heat traps and serving a nonrecirculating system shall have heat traps on both the inlet and outlet piping as close as practical to the storage tank. A heat trap is a means to counteract the natural convection of heated water in a vertical pipe run. The means is either a device specifically designed for the purpose or an arrangement of tubing that forms a loop of 360 degrees or piping that from the point of connection to the water heater (inlet or outlet) includes a length of piping directed downward before connection to the vertical piping of the supply water or hot water distribution system, as applicable.

13-412.ABC.2.5 Water flow rate controls.

13-412.ABC.2.5.1 Showers. Showers used for other than safety reasons shall be equipped with flow control devices to limit the water discharge to a maximum of 2.5 gpm (.16 L/S) per shower head at a distribution pressure of 80 psig (552 kPa) when tested in accordance with the procedures of ANSI A112.18.1M. Flow restricting inserts used as a component part of a showerhead shall be mechanically retained at the point of manufacture.

13-412.ABC.2.5.2 Lavatories or restrooms of public facilities. Lavatories or restrooms of public facilities shall:

1. Be equipped with outlet devices which limit the flow of hot water to a maximum of 0.5 gpm (.03 L/s) or be equipped with self-closing valves that limit delivery to a per cycle maximum of 0.25 gallons (.95 L) of hot water for recirculating systems and to a maximum of 0.50 gallons (1.9 L) for nonrecirculating systems.
   Exception: Separate lavatories for physically handicapped persons shall not be equipped with self-closing valves.
2. Be equipped with devices which limit the outlet temperature to a maximum of 110°F (43°C).
3. Meet the provisions of 42 CFR 6295 (k), *Standards for Water Closets and Urinals.*

13-412.ABC.2.6 Swimming pool and spa temperature controls.

13-412.ABC.2.6.1 Time switches. Time switches shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar and waste heat recovery pool heating systems.

13-412.ABC.2.6.2 Pool covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of *R*-12.

TABLE 13-411.ABC.2
MINIMUM PIPE INSULATION (inches)[1]

Fluid Design Operating Temperature Range °F	Insulation Conductivity		Nominal Pipe or Tube Size (inches)				
	Conductivity Btu in/(h ft^2 •°F)	Mean Temperature Rating	<1	1-1 ½	1 ½ to 4	4 to <8	≥8
Heating Systems (Steam, Steam Condensate, and Hot Water)[2,3]							
>350	0.32 - 0.34	250	2.5	3.0	3.0	4.0	4.0
251 - 350	0.29 - 0.32	200	1.5	2.5	3.0	3.0	3.0
201 - 250	0.27 - 0.30	150	1.5	1.5	2.0	2.0	2.0
141 - 200	0.25 - 0.29	125	1.0	1.0	1.0	1.5	1.5
105 - 140	0.22-0.28	100	0.5	0.5	1.0	1.0	1.0
Domestic and Service Hot Water Systems [3]							
>105	0.22-0.28	100	0.5	0.5	1.0	1.0	1.0
Cooling Systems (Chilled Water, Brine, and Refrigerant) [4]							
40 - 60	0.22-0.28	100	0.5	0.5	1.0	1.0	1.0
<40	0.22-0.28	100	0.5	1.0	1.0	1.0	1.5

1. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:
   $T = r\,(1+t/r)^{K/k} - 1$
   Where T = minimum insulation thickness (inches), r = actual outside radius of pipe (inches), t = insulation thickness listed in this table for applicable fluid temperature and pipe size, K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu. inches [h · ft^2 · °F]; and k = upper value of the conductivity range listed in this table for applicable fluid temperature.
2. These thicknesses are based on energy efficiency considerations only. Additional insulation is sometimes required relative to safety issues/surface temperatures.
3. Piping insulation is not required between the control valve and coil on run-outs when the control valve is located within 4 feet of the coil and the pipe size is inches or less.
4. These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.

Exception: Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source.

13-412.ABC.2.6.3 Pool heaters. Pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

13-412.ABC.3 Equipment performance standards.

13-412.ABC.3.1 Equipment efficiency. All water heating equipment, hot water supply boilers used solely for heating potable water, pool heaters, and hot water storage tanks shall meet the criteria listed in Table 13-412.ABC.3. Where multiple criteria are listed, all criteria shall be met. Omission of minimum performance requirements for certain classes of equipment does not preclude use of such equipment where appropriate. Equipment not listed in Table 13-412.ABC.3 has no minimum performance requirements.

Exception: All water heaters and hot water supply boilers having more than 140 gallons (530 L) of storage capacity are not required to meet the standby loss (SL) requirements of Table 13-412.ABC.3 when:

1. The tank surface is thermally insulated to R-12.5,
2. A standing pilot light is not installed,
3. Gas- or oil-fired storage water heaters have a flue damper or fan-assisted combustion.

13-412.ABC.3.2 Combination service water heating and space heating equipment.

13-412.ABC.3.2.1 Space heating and water heating. The use of a gas-fired or oil-fired space heating boiler system otherwise complying with Section 13-408.ABC.3 to provide the total space heating and water heating for a building is allowed when one of the following conditions is met.

1. The single space heating boiler, or the component of a modular or multiple boiler system that is heating the service water, has a standby loss in Btu/h not exceeding (13.3 x pmd + 400) / *n* where *pmd* is the probable maximum demand in gal/h, determined in accordance with the procedures described in generally accepted engineering standards and handbooks, and *n* is the fraction of the year when the outdoor daily mean temperature is greater than 64.9°F (18°C). The standby loss is to be determined for a test period of 24 hours duration while maintaining a boiler water temperature of at least 90°F (32°C) above ambient, with an ambient temperature between 60°F and 90°F (16°C and 32°C). For a boiler with a modulating burner, this test shall be conducted at the lowest input.
2. It is demonstrated to the satisfaction of the building official that the use of a single heat

source will consume less energy than separate units.

3. The energy input of the combined boiler and water heater system is less than 150,000 Btu/h (720 m²/kW).

13-412.ABC.3.2.2 Service water heating equipment. Service water heating *equipment* used to provide the additional function of space heating as part of a combination (integrated) *system* shall satisfy all stated requirements for the service water heating *equipment*.

13-412.ABC.3.2.3 Combination water and space heating systems. Combination water and space heating systems with input ratings of less than 105,000 Btu/h shall utilize a water heater listed by the Gas Appliance Manufacturer's Association (GAMA). Changeouts of burners to increase capacity shall not be made unless the unit has been listed at that capacity by GAMA.

13-412.ABC.3.2.4 Service hot water piping insulation. The following piping shall be insulated to levels shown in Table 13-411.ABC.2:

1. Recirculating system piping, including the supply and return piping of a circulating tank type water heater.
2. The first 8 feet (2438 mm) of outlet piping for a constant temperature nonrecirculating storage system.
3. The inlet pipe between the storage tank and a heat trap in a nonrecirculating storage system.
4. Pipes that are externally heated (such as heat trace or impedance heating).

13-412.A Requirements specific to Method A. Water heater efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in buildings.

SECTION 13-413
ELECTRIC POWER

13-413.0 Applicability. This section applies to all building power distribution systems. The provisions for electrical distribution for all sections of this Code are subject to the applicable Florida Public Service Commission rules regarding electric utilities set forth in Chapter 25-6, *Florida Administrative Code*, and the design conditions in ASHRAE 90.1.

13-413.ABC Mandatory requirements for Methods A, B and C.

13-413.ABC.1 Voltage drop.

13-413.ABC.1.1 Feeders and customer-owned service conductors. Feeder and customer-owned service conductors shall be sized for a maximum voltage drop of 2 percent at design load.

13-413.ABC.1.2 Branch circuits. Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent at design load.

13-413.ABC.2 Completion requirements.

13-413.ABC.2.1 Drawings. Construction documents shall require that within 30 days after the date of system acceptance, record drawings of the actual installation shall be provided to the building owner, including:

1. A single-line diagram of the building electrical distribution system and
2. Floor plans indicating location and area served for all distribution.

13-413.ABC.2.2 Manuals. Construction documents shall require that an operating manual and maintenance manual be provided to the building owner. The manuals shall include, at a minimum, the following:

1. Submittal data stating *equipment* rating and selected options for each piece of *equipment* requiring maintenance.
2. Operation manuals and maintenance manuals for each piece of *equipment* requiring maintenance. Required routine maintenance actions shall be clearly identified.
3. Names and addresses of at least one qualified service agency.

NOTE: Enforcement agencies should only check to be sure that the construction documents require this information to be transmitted to the owner and should not expect copies of any of the materials.

SECTION 13-414
MOTORS

13-414.0 Applicability. All permanently wired electric motors shall meet the requirements of Section 13-414.ABC.1.

13-414.ABC Mandatory requirements for Methods A, B and C.

13-414.ABC.1 Electric motors. Electric motors shall comply with the requirements of the Energy Policy Act of 1992 where applicable, as shown in Table 13-414.ABC.1. Motors that are not included in the scope of the Energy Policy Act have no performance requirements in this section.

SECTION 13-415
LIGHTING

13-415.0 Applicability. Lighting systems and equipment shall comply with the requirements of 13-415.ABC and applicable requirements of Appendix 13-B. This section shall apply to the following:

1. Interior spaces of buildings;
2. Exterior building features, including facades, illuminated roofs, architectural features, entrances, exits, loading docks, and illuminated canopies; and
3. Exterior building grounds lighting provided through the building's electrical service.

TABLE 13-412.ABC.3
PERFORMANCE REQUIREMENTS FOR WATER HEATING EQUIPMENT

Equipment Type	Size Category (input)	Subcategory or Rating Condition	Performance Required[1]	Test Procedure[2]
Electric Water Heaters	≤12kW	Resistance >20 gal	0.97-0.00132V EF	DOE 10 CFR Part 430[3]
	>12 kW	Resistance > 20 gal	20+35√V SL, Btu/h	ANSI Z21.10.3
	<24 Amps & <250 Volts	Heat Pump	0.93-0.00132V EF	DOE 10 CFR Part 430[3]
Gas Storage Water Heaters	<75,000 Btu/h	>20 gal	0.62-0.0019V EF	DOE 10 CFR Part 430[3]
	>75,000 Btu/h and	<4,000 (Btu/h)/gal	80%E_t (Q/800+110√V) SL, Btu/h	ANSI Z21.10.3
Gas Instantaneous Water Heaters	>50,000 Btu/h and <200,000 Btu/h[4]	>4,000 (Btu/h)/gal and < 2 gal	0.62-0.0019V EF	DOE 10 CFR Part 430
	≥200,000 Btu/h	>4,000 (Btu/h)/gal and <10 gal	80% E_t	ANSI Z21.10.3
	≥200,000 Btu/h	>4000 (Btu/h)/gal and ≥10 gal	80% E_t (Q/800+110√V) SL, Btu/h	
Heat Pump Pool Heaters	All	–	4.0 COP At low air temperature	ARI 1160[5]
Oil Storage Water Heaters	<105,000 Btu/h	>20 gal	0.59-0.0019V EF	DOE 10 CFR Part 430[3]
	>105,000 Btu/h	<4,000 (Btu/h)/gal	78% E_t (Q/800+100√V) SL, Btu/h	ANSI Z21.10.3
Oil Instantaneous Water Heaters	<210,000 Btu/h	>4,000 (Btu/h)/gal and <2 gal	0.59-0.0019V EF	DOE 10 CFR Part 430
	>210,000 Btu/h	>4,000 (Btu/h)/gal and <10 gal	80% E_t	ANSI Z21.10.3
	>210,000 Btu/h	>4,000 (Btu/h)/gal and ≥10 gal	78% E_t (Q/800+110√V) SL, Btu/h	
Hot Water Supply Boilers, Gas and Oil	≥300,000 Btu/h and <12,500,000 Btu/h	>4,000 (Btu/h)/gal and <10 gal	80% E_t	ANSI Z21.10.3
Hot Water Supply Boilers, Gas		>4000 (Btu/h)/gal and ≥10 Gal	80% E_t (Q/800+110√V) SL, Btu/h	
Hot Water Supply Boilers, Oil		>4000 (Btu/h)/gal and ≥10 Gal	78% E_t (Q/800+110√V) SL, Btu/h	
Pool Heaters, Oil and Gas	All		78% E_t	ASHRAE 146
Unfired Storage Tanks	All		R-12.5	(none)

For SI: 1Btu/h = .2931W, °C = [(°F) - 32]/1.8

1. Energy factor (ER) and thermal efficiency (Et) are minimum requirements, while standby loss (SL) is maximum Btu/h based on a 70°F temperature difference between stored water and ambient requirements. In the EF equation, V is the rated volume in gallons. In the SL equation, V is the rated volume in gallons and Q is the nameplate input rate in Btu/h.
2. Subchapter 13-3 contains a complete specification, including year version, of the referenced test procedure.
3. Electric, gas and oil water heaters' EF ratings in the residential size range are the same as those found in Table 13-612.ABC.3.2 of this code.
4. Instantaneous water heaters with input rates below 200,000 Btu/h must comply with these requirements if the water heater is designed to heat water to temperatures 180°F or higher.
5. Test reports from independent laboratories are required to verify procedure compliance.

1. Emergency lighting that is automatically off during normal building operation,
2. Lighting within living units,
3. Lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation,
4. Decorative gas lighting systems.

13-415.ABC Mandatory requirements for Methods A, B and C.

13-415.ABC.1 Controls.

13-415.ABC.1.1 Automatic lighting controls. Interior lighting in buildings larger than 5,000 square feet (465 m^2) shall be controlled with an automatic control device to shut off building lighting in all spaces. This automatic control device shall function on either:

1. A scheduled basis using a time-of-day operated control device that turns lighting off at specific programmed times—an independent program schedule shall be provided for areas of no more

than 25,000 square feet (2323 m^2) but not more than one floor.

2. An occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space.
3. A signal from another control or alarm system that indicates the area is unoccupied.

Exceptions: The following shall not require an automatic control device.

a. Lighting intended for 24-hour operation.
b. Lighting in spaces where patient care is rendered.
c. Spaces where an automatic shutoff would endanger the safety or security of the room's or building's occupant(s).

13-415.ABC.1.2 Space control. Each space enclosed by ceiling-height partitions shall have at least one control device to independently control the general lighting within the space. Each manual device shall be readily accessible and located so the occupants can see the controlled lighting.

a. A control device shall be installed that automatically turns lighting off within 30 minutes of all occupants leaving a space, except spaces with multiscene control, in the following:
    1. Classrooms (not including shop classrooms, laboratory classrooms, and preschool through 12th grade classrooms).
    2. Conference/meeting rooms.
    3. Employee lunch and break rooms.

    These spaces are not required to be connected to other automatic lighting shutoff controls.
b. For all other spaces, each control device shall be activated either manually by an occupant or automatically by sensing an occupant. Each control device shall control a maximum of 2,500 square feet (232 m^2) area for a space 10,000 square feet (929 m^2) or less; and a maximum of 10,000 square feet (929 m^2) area for a space greater than 10,000 square feet (929 m^2); and be capable of overriding any time-of-day scheduled shut-off control for no more than 4 hours.

    Exception: Remote location shall be permitted for reasons of safety or security when the remote control device has an indicator pilot light as part of or next to the control device, and the light is clearly labeled to identify the controlled lighting.

13-415.ABC.1.3 Additional controls. Controls are required in the following cases:

1. Display or accent lighting. Display or accent lighting shall have a separate control.
2. Case lighting. Lighting in cases used for display purposes shall have a separate control device.
3. Hotel and motel guest room lighting. Hotel and motel guest rooms and guest suites shall have a

TABLE 13-414.ABC.1
MINIMUM NOMINAL EFFICIENCY FOR GENERAL PURPOSE Design A and Design B Motors[1]

	Minimal Nominal Full-Load Efficiency (%)					
	Open Motors			Enclosed Motors		
Number of Poles	2	4	6	2	4	6
Synchronous speed (RPM)	3600	1800	1200	3600	1800	1200
Motor Horsepower						
1.0	— —	82.5	80.0	75.5	82.5	80.0
1.5	82.5	84.0	84.0	82.5	84.0	85.5
2.0	84.0	84.0	85.5	84.0	84.0	86.5
3.0	84.0	86.5	86.5	85.5	87.5	87.5
5.0	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	88.5	89.5	89.5
10.0	88.5	89.5	90.2	89.5	89.5	89.5
15.0	89.5	91.0	90.2	90.2	91.0	90.2
20.0	90.2	91.0	91.0	90.2	91.0	90.2
25.0	91.0	91.7	91.7	91.0	92.4	91.7
30.0	91.0	92.4	92.4	91.0	92.4	91.7
40.0	91.7	93.0	93.0	91.7	93.0	93.0
50.0	92.4	93.0	93.0	92.4	93.0	93.0
60.0	93.0	93.6	93.6	93.0	93.6	93.6
75.0	93.0	94.1	93.6	93.0	94.1	93.6
100.0	93.0	94.1	94.1	93.6	94.5	94.1
125.0	93.6	94.5	94.1	94.5	94.5	94.1
150.0	93.6	95.0	94.5	94.5	95.0	95.0
200.0	94.5	95.0	94.5	95.0	95.0	95.0

1. Nominal efficiencies shall be established in accordance with NEMA Standard MG1. Design A and Design B are National Electric Manufacturers Association (NEMA) design class designations for fixed frequency small and medium AC squirrel-cage induction motors.

master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.

4. Task lighting. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible and located so that the occupant can see the controlled lighting.
5. Nonvisual lighting. Lighting for nonvisual applications, such as plant growth and food warming, shall have a separate control device.
6. Demonstration lighting. Lighting equipment that is for sale or for demonstrations in lighting education shall have a separate control device.

13-415.ABC.1.4 Exterior lighting control. Lighting for all exterior applications not exempted in Section 13-415.0 shall have automatic controls capable of turning off exterior lighting when sufficient daylight is available, or when the lighting is not required during nighttime hours. Lighting not designated for dusk-to-dawn operation shall be controlled by an astronomical time switch. Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. Astronomical time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.

Exception: Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

13-415.ABC.2 Exterior lighting.

13-415.ABC.2.1 Exterior building grounds lighting. All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lm/W unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Sections 13-415.0 and 13-415.ABC.2.2.

13-415.ABC.2.2 Exterior building lighting power. The total exterior lighting power allowance for all exterior building applications is the sum of the individual lighting power densities permitted in Table 13-415.ABC.2.2 for these applications, plus an additional unrestricted allowance of 5% of that sum. Trade-offs are allowed only among exterior lighting applications listed in the Table 13-415.ABC.2.2 "Tradable Surfaces" section. Exterior lighting for all applications (except those included in the exceptions to Sections 13-415.0 and this section) shall comply with the requirements of Section 13-415.ABC.2.1.

Exceptions: Lighting used for the following exterior applications is exempt when equipped with a control device independent of the control of the nonexempt lighting:

(a) specialized signal, directional, and marker lighting associated with transportation;
(b) advertising signage or directional signage;
(c) Lighting that is integral to equipment or instrumentation and is installed by its manufacturer;
(d) Lighting for theatrical purposes, including performance, stage, film and video production;
(e) Lighting for athletic playing areas;
(f) Temporary lighting;
(g) Lighting for industrial production, material handling, transportation sites and associated storage areas;
(h) Theme elements in theme/amusement parks; and
(i) Lighting used to highlight features of public monuments and registered historic landmark structures or buildings.

13-415.ABC.3 Tandem wiring. Luminaires designed for use with one or three linear fluorescent lamps >30W each shall use two-lamp tandem-wired ballasts in place of single lamp ballasts when two or more luminaires are in the same space and on the same control device.

Exceptions:

1. Recessed luminaires more than 10 feet (3048 mm) apart measured center to center.
2. Surface-mounted or pendant luminaires that are not continuous.
3. Luminaires using single-lamp high-frequency electronic ballasts.
4. Luminaires using three-lamp high-frequency electronic or three-lamp electromagnetic ballasts.
5. Luminaires on emergency circuits.
6. Luminaires with no available pair.

13-415.ABC.4 Exit signs. Internally illuminated exit signs shall not exceed 5 watts per face.

13-415.ABC.5 Interior lighting power, scope. The *interior lighting power allowance* for a building or a separately metered or permitted portion of a *building* shall be determined by either the *building* area method described in Section 13-415.C.1 or the space-by-space method described in Section 13-415.B.1. Trade-offs of *interior lighting power allowance* among portions of the *building* for which a different method of calculation has been used are not permitted. The *installed interior lighting power* identified in accordance with Section 13-415.ABC.5.1 shall not exceed the *interior lighting power allowance* developed in accordance with Section 13-415.C.1 or 13-415.B.1

Exceptions: The following *lighting equipment* and applications shall not be considered when determining the interior lighting power allowance developed in accordance with Sections 13-415.C.1 or 13-415.B.1, nor shall the wattage for such lighting be included in the installed interior lighting power identified in accordance with

Section 13-415.ABC.5.1. However, any such lighting shall not be exempt unless it is an addition to general lighting and is controlled by an independent control device.

1. Display or accent lighting that is an essential element for the function performed in galleries, museums, and monuments.
2. Lighting that is integral to equipment or instrumentation and is installed by its manufacturer.
3. Lighting specifically designed for use only during medical or dental procedures and lighting integral to medical equipment.
4. Lighting integral to both open and glass enclosed refrigerator and freezer cases.
5. Lighting integral to food warming and food preparation equipment.
6. Lighting for plant growth or maintenance.
7. Lighting in spaces specifically designed for use by the visually impaired.
8. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
9. Lighting in interior spaces that have been specifically designated as a registered interior historic landmark.
10. Lighting that is an integral part of advertising or directional signage.
11. Exit signs.
12. Lighting that is for sale or lighting educational demonstration systems.
13. Lighting for theatrical purposes, including performance,stage, and film and video production.
14. Lighting for television broadcasting in sporting activity areas.
15. Casino gaming areas.

13-415.ABC.5.1 Installed interior lighting power. The installed interior lighting power shall include all power used by the luminaires, including lamps, ballasts, current regulators, and control devices except as specifically exempted in Section 13-415.ABC.5.

Exception: If two or more independently operating lighting systems in a space are capable of being controlled to prevent simultaneous user operation, the installed interior lighting power shall be based solely on the lighting system with the highest wattage

13-415.A Requirements specific to Method A. Lighting levels and types determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the maximum performance levels installed for lighting.

13-415.B Requirements specific to Method B. Lighting levels and types determined by the EnergyGauge Summit Fla/Com Method B performance calculation to demonstrate compliance with this code shall be the maximum performance levels installed for lighting.

13-415.B.1 Space-by-space method of calculating interior lighting power allowance. EnergyGauge Summit Fla/Com uses the following steps to determine the interior lighting power allowance by the space-by-space method.

1. Determine the appropriate building type from Table 13-415.B.1. For building types not listed, selection of a reasonably equivalent type shall be permitted.
2. For each space enclosed by partitions 80 percent or greater than ceiling height, determine the gross interior floor area by measuring to the center of the partition wall. Include the floor area of balconies or other projections. Retail spaces do not have to comply with the 80-percent partition height requirements.
3. Determine the interior lighting power allowance by using the columns designated space-by-space method in Table 13-415.B.1. Multiply the floor area(s) of the space(s) times the allowed lighting power density for the space type that most closely represents the proposed use of the space(s). The product is the lighting power allowance for the space(s). For space types not listed, selection of a reasonable equivalent category shall be permitted.
4. The interior lighting power allowance is the sum of lighting power allowances of all spaces. Trade-offs among spaces are permitted provided that the total installed interior lighting power does not exceed the interior lighting power allowance.

TABLE 13-415.ABC.2.2
LIGHTING POWER DENSITIES FOR BUILDING EXTERIORS

APPLICATIONS	LIGHTING POWER DENSITIES
Tradable Surfaces (Lighting Power Densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs, and outdoor sales areas may be traded.)	
Uncovered Parking Areas	
Parking lots and drives	0.15 W/ft^2
Building Grounds	
Walkways less than 10 feet wide	1.0 watts per linear foot
Walkways 10 feet wide or greater, plaza areas, and special feature areas	0.2 W/ft^2
Stairways	1.0 W/ft^2
Building Entrances and Exits	
Main entries	30 watts per linear foot of door width
Other doors	20 watts per linear foot of door width
Canopies and Overhangs	
Canopies (free-standing and attached) and overhangs	1.25 W/ft^2
Outdoor Sales	
Open areas (including vehicle sales lots)	0.5 W/ft^2

(continued)

TABLE 13-415.ABC.2.2 - continued
LIGHTING POWER DENSITIES FOR BUILDING EXTERIORS

Street frontage for vehicle sales lots in addition to "open area" allowance	20 watts per linear foot
Nontradable Surfaces (Lighting Power Density calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "Tradable Surfaces" section of this table.)	
Building facades	0.2 W/ft^2 for each illuminated wall or surface or 5.0 watts per linear foot for each illuminated wall or surface length
Automated teller machines and night depositories	270 watts per location plus 90 watts per additional ATM per location
Entrances and gatehouse inspection stations at guarded facilities	1.25 W/ft^2 of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")
Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.5 W/ft^2 of uncovered area (covered areas are included in the Canopies and Overhangs" section of "Tradable Surfaces")
Drive-up windows at fast food restaurants	400 watts per drive-through
Parking near 24-hour retail entrances	800 watts per main entry

13-415.B.2 Additional interior lighting power. When using the space-by-space method, an increase in the interior lighting power allowance is allowed for specific lighting functions. Additional power shall be allowed only if the specified lighting is installed, shall be used only for the specified luminaires, and shall not be used for any other purpose or in any other space. An increase in the interior lighting power allowance is permitted in the following cases:

1. For spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance, such as chandelier-type luminaries or sconces or for highlighting art or exhibits, provided that the additional lighting power shall not exceed 1.0 watts per square foot of such spaces.
2. For spaces in which lighting is specified to be installed to meet the requirements of visual display terminals as the primary viewing task, provided that the additional lighting power shall not exceed 0.35 watts per square foot of such spaces and that the specified luminaire meets requirements for use in such spaces. Maximum average luminance measured from the vertical in candelas per square foot of not more than 80 cd/ft^2 at 65 degrees, 33 cd/ft^2 at 75 degrees, and 17 cd/ft^2 at 85 to 90 degrees.
3. For lighting equipment installed in retail spaces that is specifically designed and directed to highlight merchandise, provided that the additional lighting power shall not exceed
   (1) 1.6 watts per square foot times the area of specific display or
   (2) 3.9 watts per square foot times the area of specific display for valuable merchandise, such as jewelry, fine apparel and accessories, china and silver, art, and similar items, where detailed display and examination of merchandise are important.

13-415.C Requirements specific to Method C.

13-415.C.1 Building area method of calculating interior lighting power allowance. Use the following steps to determine the interior lighting power allowance by the building area method:

1. Determine the appropriate building area type from Table 13-415.C.1 and the allowed lighting power density (watts per unit area) from the building area method column. For building area types not listed, selection of a reasonably equivalent type shall be permitted.
2. Determine the gross lighted floor area (square feet) of the building area type.
3. Multiply the gross lighted floor areas of the building area type(s) times the lighting power density.
4. The interior lighting power allowance for the building is the sum of the lighting power allowances of all building area types. Trade-offs among building area types are permitted provided that the total installed interior lighting power does not exceed the interior lighting power allowance.

TABLE 13-415.B.1
LIGHTING POWER DENSITIES (LPD) USING THE SPACE-BY-SPACE METHOD

Common Space Types[1]	LPD (W/ft²)	Building Specific Space Types (Continued)	LPD (W/ft²)
Office—enclosed	1.1	Fire stations	
Office—open plan	1.1	Fire station engine room	0.8
Conference/Meeting/Multipurpose	1.3	Sleeping quarters	0.3
Classroom/Lecture/Training	1.4	Post Office—sorting area	1.2
for Penitentiary	1.3	Convention center—exhibit space	1.3
Lobby	1.3	Library	
for Hotel	1.1	Card file & cataloging	1.1
for Performing arts theater	3.3	Stacks	1.7
for Motion picture theater	1.1	Reading area	1.2
Audience/seating area	0.9	Hospital	
for Gymnasium	0.4	Emergency	2.7
for Exercise center	0.3	Recovery	0.8
for Convention center	0.7	Nurse station	1.0
for Penitentiary	0.7	Exam/Treatment	1.5
for Religious buildings	1.7	Pharmacy	1.2
for Sports arena	0.4	Patient room	0.7
for Performing arts theater	2.6	Operating room	2.2
for Motion picture theater	1.2	Nursery	0.6
for Transportation	0.5	Medical supply	1.4
Atrium—first three floors	0.6	Physical therapy	0.9
Atrium—each additional floor	0.2	Radiology	0.4
Lounge/Recreation	1.2	Laundry/Washing	0.6
for Hospital	0.8	Automotive—Service/Repair	0.7
Dining area	0.9	Manufacturing	
for Penitentiary	1.3	Low bay (<25 ft floor to ceiling height)	1.2
for Hotel	1.3	High bay (>25 ft floor to ceiling height)	1.7
for Motel	1.2	Detailed manufacturing	2.1
for Bar lounge/Leisure dining	1.4	Equipment room	1.2
for Family dining	2.1	Control room	0.5
Food preparation	1.2	Hotel/Motel guest rooms	1.1
Laboratory	1.4	Dormitory—Living quarters	1.1
Restrooms	0.9	Museum	
Dressing/Locker/Fitting room	0.6	General exhibition	1.0
Corridor/Transition	0.5	Restoration	1.7
for Hospital	1.0	Bank/Office—banking activity area	1.5
for Manufacturing facility	0.5	Religious buildings	
Stairs—active	0.6	Worship—pulpit, choir	2.4
Active storage	0.8	Fellowship hall	0.9
for Hospital	0.9	Retail (for accent lighting see Sec. 415.2.B.2)	
Inactive storage	0.3	Sales area	1.7
for Museum	0.8	Mall concourse	1.7
Electrical/mechanical	1.5	Sports arena	
Workshop	1.9	Ring sports area	2.7
		Court sports area	2.3
Building Specific Space Types		Indoor playing field area	1.4
Gymnasium/Exercise center		Warehouse	
Playing area	1.4	Fine material storage	1.4
Exercise area	0.9	Medium/bulky material storage	0.9
Courthouse/Police station/Penitentiary		Parking garage—garage area	0.2
Courtroom	1.9	Transportation	
Confinement cells	0.9	Airport—concourse	0.6
Judges chambers	1.3	Air/Train/Bus—Baggage area	1.0
		Terminal—Ticket counter	1.5

For SI: 1 foot = 304.8 mm.

a. In cases where both a common space type and a building specific space type are listed, the building specific space type shall apply.

TABLE 13-415.C.1
LIGHTING POWER DENSITIES USING
THE BUILDING AREA METHOD

Building Area Type[a]	Lighting Power Density (W/ft^2)
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Health Care–Clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theater	1.2
Multiple-Family	0.7
Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/Fire Station	1.0
Post Office	1.1
Religious Building	1.3
Retail	1.5
School/University	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

a. In cases where both general building area type and a specific building area type are listed, the specific building area type shall apply.

SUBCHAPTER 13-6
RESIDENTIAL BUILDING COMPLIANCE METHODS

SECTION 13-600
ADMINISTRATION

13-600.1 Methods of compliance. Scope. This chapter provides three Methods by which residential buildings may be brought into compliance with this code.

13-600.1.1 Method A, the Whole Building Performance Method. This is a performance based code compliance method which considers energy use for the whole building, both for the envelope and its major energy-consuming systems. Under this method, energy loads are calculated for the energy-consuming elements of an as-built house and simultaneously for a baseline house of the same configuration. The as-built normalized modified energy loads shall be less than the baseline energy loads to comply with this code. Applicable performance criteria in Appendix C shall be followed. Applicable requirements described in Sections 13-601 through 13-613 shall also be met.

Method A may be applied to demonstrate code compliance for new residential construction, both single-family detached and multiple-family attached structures, and to additions to existing residential buildings. Existing buildings not exempt from this code may be brought into compliance by this method.

13-600.1.1.1 As an alternative to the computerized Compliance Method A, the Alternate Residential Point System Method hand calculation, Alternate Form 600A, may be used. All requirements specific to this calculation are located in Appendix 2C. Buildings complying by this alternative shall meet all mandatory requirements of this chapter. Computerized versions of the Alternate Residential Point System Method shall not be acceptable for code compliance.

13-600.1.2 Method B, the Component Prescriptive Method. This is a prescriptive code compliance Method for residences of three stories or less and additions. Using this method, a residence would meet or exceed all requirements for the list of minimum component requirements.

Exceptions: Method B shall not be applied in new construction, including additions, that incorporates the following:

1. Skylights.
2. Windows with greater than 16 percent glass to floor area.
3. Electric resistance heat.

13-600.1.3 Method C, Limited Applications Prescriptive Method. This is a prescriptive code compliance method for residential additions of 600 square feet (56 m^2) or less, renovations to existing residential buildings; heating, cooling, and water heating systems of existing buildings; and site-added components of manufactured homes and manufactured buildings. To comply by this method, all energy-related components or systems being installed or changed in the addition or renovation shall meet the minimum prescriptive levels listed for that component.

13-600.2 Forms. Code compliance by this subchapter shall be demonstrated by completing and submitting to the building official the appropriate forms described below. An original form or EnergyGauge USA–Fla/Res 2007 computerized printout, accompanied by a copy of the front page of the form as provided in Section 13-105.0, shall be submitted to the building department to demonstrate compliance with this code before a building permit is issued.

Method A compliance	Form 1100A-07 (Fla/Res computerized printout)
or	Form 600A-07 (hand calculation)
Method B compliance	Form 1100B-07
Method C compliance	Form 1100C-07

13-600.2.1 Form 1100D-07 (desuperheater, heat recovery unit water heater efficiency certification). This form shall be submitted when credit is being taken for water heating with a heat recovery unit. The form is used to demonstrate that the net superheat recovery is equal to or greater than the 50 percent minimum required to obtain credit. The form shall be affixed to the heat recovery unit by the manufacturer.

Exception: If the heat recovery unit is listed in the current ARDM Directory of Certified Refrigerant Desuperheater Heat Recovery Unit Water Heaters as meeting the net heat recovery minimum and the unit bears the ARDM label signifying compliance with this code, the label shall serve as a certification in place of Form 1100D-07.

13-600.2.2 EPL display card. The building official shall require that an energy performance level (EPL) display card be completed and certified by the builder to be accurate and correct before final approval of a residential building for occupancy. The EPL display card contains information indicating the energy performance level and efficiencies of components installed in a dwelling unit. The EPL display card shall be included as an addendum to the sales contract for both presold and nonpresold residential buildings in accordance with Section 553.9085, *Florida Statutes*.

13-600.2.3 Availability. Forms may be found in Appendix 13-D or online at www.floridabuilding.org. The EnergyGauge USA–Fla/Res 2007 computer program may be found online at www.energygauge.com.

13-600.3 Types of requirements. Mandatory requirements shall be met for all buildings. The section number followed by the combined number and letters ".ABC" indicates these mandatory requirements (i.e., requirements that shall be met by buildings complying by either Method A, B or C) in Sections 13-601 through 13-613. Requirements specific to Method A, B or C (i.e., ".B" is specific to Method B) shall be met when complying with the code by that method. Prescriptive requirements for Methods B or C may be more stringent than the basic prescriptive requirements and shall supersede them. General re-

quirements contained in Appendix 13-C for building material properties, testing and installation shall be followed.

13-600.A Requirements specific to Method A.

13-600.A.1 General. Requirements specific to Method A are included in the text under the applicable building component section. Compliance is by Form 1100A-07 produced by the EnergyGauge USA–Fla/Res 2007 computer program. The Method A calculation shall result in either a PASS or FAIL status. For a building to pass, the total energy score calculated for the as-built house shall be less than or equal to the total energy score calculated for the baseline house. The baseline features and calculation procedures contained in Section 13-613 and in Appendix 13-C shall be used to demonstrate code compliance of the building design for residential buildings complying by Method A. Except where prescribed elsewhere, efficiencies described in the Method A calculation submittal to demonstrate compliance with this code shall be the minimum level installed for each component.

13-600.A.1.1 Insulation *R*-values. *R*-values used for the insulation level installed shall be the *R*-value of the added insulation only. Appendix 13-C, Section C1.2, contains general rules for insulation that shall be followed.

13-600.A.1.2 Areas. Areas used in the calculation shall be the actual net areas for each component determined from the plans and specifications of the building to be constructed.

13-600.A.2 Energy loads. Energy loads for Method A compliance are as provided in the EnergyGauge USA–Fla/Res 2007 computer program.

13-600.A.3 Residences not heated or not cooled. Residences which are heated or cooled, but not both, shall complete both summer and winter calculations. If an addition or part of an addition is claimed to be exempt from the code because it will be neither heated nor cooled, the exempt area shall be fully separated from the conditioned area by walls or doors.

13-600.A.4 Worst-case calculations. Residential occupancies which are identical in configuration, square footage, and building materials may comply with the code by performing a worst-case calculation using compliance Method A. A worst case calculation generates the highest as-built energy score in a Method A calculation. When submitting worst-case calculations, copies of the Form 1100A shall be submitted or referenced with each set of plans, dependent on the requirements of the building department.

13-600.A.5 Additions.

13-600.A.5.1 Additions complying alone. Additions to existing buildings shall follow the same Method A calculation procedure as new construction with the following qualifications.

1. Calculations shall be conducted using only the components of the addition itself, including those preexisting components which separate the addition from unconditioned spaces.
2. Heating and cooling system loads shall be equal to the baseline system loads unless new equipment is installed to replace existing equipment or to service the addition specifically.
3. Water heating is not included in the calculation unless a supplemental water heater is installed, an existing water heater is replaced, or an alternative water heater (gas, solar, HRU, dedicated heat pump) is installed.

13-600.A.5.2 Additions unable to comply alone. Additions may comply with the code requirements for the addition alone or by demonstrating that the entire building, including the addition, complies with the code requirements for new buildings using compliance Method A. Section 13-600.A.5.2.1 contains restrictions which shall apply if the entire building is used to demonstrate compliance.

13-600.A.5.2.1 Assumptions for existing building efficiencies. The following restrictions apply if the entire building is used to demonstrate code compliance:

1. The owner shall demonstrate to the building department's satisfaction that all *R*-values and equipment efficiencies claimed are present. If the building was built after 1980, the original energy code submittal may be used to demonstrate efficiencies.
2. If it is apparent from inspection that no insulation is present in the existing walls, floors or ceilings, or if inspection is not possible, an *R*-value of zero (0) shall be used for that component in the calculation. If, as part of the addition and renovation project, insulation or equipment in the existing structure is upgraded, the new values may be used in the calculation.
3. If, upon inspection, insulation is found but the *R*-value is unknown, then an *R*-value shall be determined by an energy audit utilizing current acceptable practice based on insulation thickness, density and type.
4. Equipment efficiencies shall be demonstrated, either from manufacturer's literature or certified equipment directories, or by the procedure provided in Section 13-607.ABC.3 based on system capacity and total on-site energy input. Equipment to be added shall meet the applicable minimum equipment efficiency from Tables 13-607.ABC.3.2A, 13-607.ABC.3.2B, 13-607.ABC.3.2D, 13-608.ABC.3.2E and 13-608.ABC.3.2F. Existing residential equipment not meeting the efficiencies in Tables 13-607.ABC.3.2A, 13-607.ABC.3.2B, 13-607.ABC.3.2D, 13-608.ABC.3.2E, and 13-608.ABC.3.2F shall utilize the cooling or heating system efficiencies provided in Tables 13-C4.1.1A to 13-C4.1.1B of Appendix 13-C.
5. Any nonvertical roof glass shall be calculated as horizontal glazing.

13-600.A.6 Multiple-family occupancies.

13-600.A.6.1 Common conditioned spaces. Common conditioned spaces occurring in multiple-family buildings that are not part of specific tenancy units, such as corridors, lobbies, recreation rooms, offices, etc., shall be calculated using one of the following procedures:

1. No energy use calculation is required for common areas if less than 5 percent of the building area is used for such common areas.
2. Corridors, lobbies and similar areas shall be calculated using Subchapter 13-4.
3. Nonresidential occupancies within a multiple-family structure such as cafeterias, offices, and gyms shall be calculated in accordance with Subchapter 13-4.

13-600.B Requirements specific to Method B. Requirements specific to Method B are included in the text under the applicable building component section. Compliance is by Form 1100B-07. This compliance method provides a list of requirements that must be met or exceeded. Any practice, system, or rating for which the energy performance determined from compliance Method A meets or exceeds the energy performance of the prescribed practice or system in the same climate zone may be used to comply with the Method B requirements. No substitutions or variations less energy efficient than the established levels and standards listed for each component type shall be permitted. No components or systems shall be installed with efficiencies less than the mandatory requirements for that component or system.

13-600.C Requirements specific to Method C. Requirements specific to Method C are included in the text under the applicable building component section. Compliance is by Form 1100C-07. This compliance method provides a list of requirements that must be met or exceeded, if applicable, for additions of 600 square feet or less, renovations (see definition), and site-installed components of manufactured homes and manufactured buildings.

13-600.C.1 Additions. Requirements shall apply only to building components and equipment being added to an addition or replaced in an existing building to service an addition. Existing components or systems in a residence need not meet the requirements. Substitutions or variations that are less energy efficient than the prescribed efficiency levels and standards listed shall not be permitted.

13-600.C.2 Renovations. Requirements shall apply only to those components or systems being repaired or replaced.

13-600.C.3 Manufactured homes and manufactured buildings. Requirements specified for manufactured homes and manufactured buildings shall be met for all site-installed components and features of such buildings at the time of first setup. Complete code compliance shall be demonstrated for manufactured buildings.

SECTION 13-601
FENESTRATIONS (GLAZING)

13-601.ABC Mandatory requirements for Methods A, B and C.

13-601.ABC.1 Window efficiencies. Windows shall have no higher *U*-factor or solar heat gain coefficient (SHGC) than that certified to be in compliance with the code. Unlabeled windows shall use the default *U*-factor and SHGC criteria of Section C2.1.1 in Appendix 13-C of this chapter.

Glazing in doors shall be considered fenestrations.

13-601.ABC.2 Window infiltration. Windows shall meet the minimum air infiltration requirements of Section 13-606.1.

13-601.ABC.3 Overhangs. Nonpermanent shading devices such as canvas awnings shall not be considered overhangs. Permanently attached wood and metal awnings may be considered overhangs.

13-601.A Requirements specific to Method A. The type of window to be installed shall have properties at least as efficient as the window(s) used to calculate Form 1100A. Window performance criteria are as contained in the EnergyGauge USA Fla/Res computer program.

13-601.A.1 Glass orientation. Glazing shall be considered in the Method A calculation by orientation of all windows and skylights.

13-601.A.2 Glass types. Glazing shall be considered by its *U*-factor and its solar heat gain coefficient (SHGC), or, if unlabeled, default values shall be assumed as per Section 13-C2.1.1 of Appendix 13-C of this chapter.

13-601.A.3 Glass overhangs. Overhang effect is measured in EnergyGauge USA Fla/Res by overhang separation, which is the vertical measure of the distance from the top of a window to the bottom of the overhang. The overhang for adjustable exterior shading devices shall be determined at its most extended position.

13-601.A.4 Glass areas. All glazing areas of a residence, including windows, sliding glass doors, glass in doors, skylights, etc., shall include the manufacturer's frame area in the total window area. Window measurements shall be as specified on the plans and specifications for the residence.

Exception: When a window in existing exterior walls is enclosed by an addition, an amount equal to the area of this window may be subtracted from the glazing area for the addition for that overhang and orientation.

13-601.B Requirements specific to Method B. All glass in residential buildings complying by Method B, including sliding glass doors and glass in exterior doors that has an area one-third or more of the total door area, shall meet the criteria in Sections 13-601.B.1 through 13-601.B.3.

13-601.B.1 Percentage of glass. The percentage of glass area to conditioned floor area shall not exceed 16 percent.

Exception: When glass in existing exterior walls is being removed or enclosed by an addition, an amount equal to the total area of this glass may be subtracted from the

total glass area prior to determining the installed glass percentage.

13-601.B.2 Glass type. All glass shall have *U*-factors and solar heat gain coefficients no higher than those listed from Table 11B-1 on Form 1100B.

13-601.C Requirements specific to Method C.

13-601.C.1 Additions. All glazing in residential additions complying by Method C shall meet the minimum criteria given on Table 11C-2 of Form 1100C for new glazing installed in the addition. All new glazing shall meet the overhang (OH) and the solar heat gain coefficient (SHGC) criteria of one of the alternative requirement sets in Table 11C-2 on Form 1100C for the type of glass and the percentage of glass to floor area categories on the form for glass installed in the addition. Glass windows and doors that were previously located in an existing exterior wall that is being removed or enclosed by an addition do not have to comply with the overhang and solar heat gain coefficient requirements listed on Table 11C-2 of Form 1100C when reinstalled as part of the addition.

13-601.C.1.1 Glazing area. The maximum percentage of glass-to-floor area allowed for additions of 600 square feet (56 m^2) or less shall be 50 percent. The total glazing area calculated shall include the areas of windows, sliding glass doors, all areas which exceed one-third the area of the door in which they are located, and double the area of all skylights or other nonvertical roof glass. When glass in existing exterior walls is being removed or enclosed by an addition, an amount equal to the total area of this glass may be subtracted from the total glass area prior to determining the installed glass percentage.

13-601.C.1.2 Between range calculation. In cases where an overhang length or solar heat gain coefficient falls between two glass percentage ranges and the glass type is the same throughout the addition, the specific glass percentage allowed may be determined by using the following equations:

Overhang (OH):

$$\text{Glass \% Allowed} = \text{Low\% Glass} + \frac{\text{High\% Glass} - \text{Low\% Glass}}{\text{OH}_{\text{High\%}} - \text{OH}_{\text{Low\%}}} \times [\text{OH}_{\text{Installed}} - \text{OH}_{\text{Low\%}}]$$

Solar heat Gain Coefficient (SHGC):

$$\text{Glass \% Allowed} = \text{Low\% Glass} + \frac{\text{High\% Glass} - \text{Low\% Glass}}{\text{SHGC}_{\text{High\%}} - \text{SHGC}_{\text{Low\%}}} \times [\text{SHGC}_{\text{Installed}} - \text{SHGC}_{\text{Low\%}}]$$

13-601.C.2 Renovations. New windows installed in renovations may be of any glass type and solar heat gain coefficients where glass areas are under an overhang of at least 2 feet (610 mm) whose lower edge does not extend further than 8 feet (2438 mm) from the overhang. Glass areas that do not meet this criteria shall be either single-pane tinted, double-pane clear, or double-pane tinted in accordance with Table 13-C.2.1.1 in Appendix 13-C of this chapter. All skylights or nonvertical glass shall be double paned or single paned with a diffuser.

Exception: These requirements apply only to glass that is being replaced.

SECTION 13-602
WALLS

13-602.ABC Mandatory requirements for Methods A, B and C.

13-602.ABC.1 Wall insulation. Walls shall be insulated to at least the level certified to be in compliance with this code on the code compliance form.

Insulation *R*-values claimed shall be in accordance with the criteria described in Section 13-C1.2 of Appendix 13-C.

13-602.ABC.1.1 Common walls. Walls common to two separate conditioned tenancies shall be insulated to a minimum of R-11 for frame walls, and to R-3 on both sides of common masonry walls.

13-602.ABC.1.2 Walls considered ceiling area. Wall areas that separate conditioned living space from unconditioned attic space (such as attic knee walls, walls on cathedral ceilings, skylight chimney shafts, gambrel roofs, etc.) shall be considered ceiling area and have a minimum insulation value of R-19.

13-602.ABC.2 Wall infiltration. Walls shall meet the minimum air infiltration requirements of Section 13-606.ABC.

13-602.A Requirements specific to Method A.

13-602.A.1 Wall types. Walls entered into the EnergyGauge USA Fla/Res program shall be identified in sufficient detail for the building official to determine whether their characteristics are adequately represented on the form submitted for code compliance.

13-602.B Requirements specific to Method B. Walls shall be either frame or masonry construction, including face brick, to comply with this Method. All exterior and adjacent walls shall be insulated to the minimum *R*-value given on Table 11B-1 of Form 1100B for the compliance package chosen in accordance with the criteria in Section 13-C1.2 of Appendix 13-C.

13-602.C Requirements specific to Method C.

13-602.C.1 Additions. All walls shall be insulated to the minimum *R*-value given on Table 11C-1 of Form 1100C for the type of construction used in the addition.

13-602.C.1.1 Frame walls. The minimum insulation level installed in wood or metal frame walls shall be R-11 for 2- by 4-inch walls and R-19 for 2- by 6-inch walls.

13-602.C.1.2 Concrete or masonry walls. The minimum *R*-value of insulation added to exterior and adjacent masonry walls shall be the value listed on Form 1100C.

13-602.C.2 Renovations. Minimum insulation levels installed in renovated walls shall be not less than those specified in Section 13-602.C.1. These requirements apply only to those walls being renovated.

13-602.C.3 Manufactured homes and manufactured buildings. Marriage walls between sections of double wide or multiple units shall be sealed with long-life caulk or

gasketing and shall be mechanically fastened in accordance with the manufacturer's instructions. See also the Section 13-610.C.3 requirements for ducts located in marriage walls of multiple unit manufactured homes and buildings.

SECTION 13-603
DOORS

13-603.ABC Mandatory requirements for Methods A, B and C.

13-603.ABC.1 Door types allowed. All exterior and adjacent doors other than glass doors shall be solid core wood, wood panel, or insulated doors. Hollow core doors shall not be used in either exterior or adjacent walls. Doors may have glass sections.

13-603.ABC.2 Door infiltration. Doors shall meet the minimum air infiltration requirements for doors contained in Section 13-606.ABC.1.1.

13-603.A Requirements specific to Method A.

13-603.A.1 Door types. Doors shall be identified as either exterior or adjacent, based on the type of wall in which they are located, and in sufficient detail for the building official to determine whether their characteristics are adequately represented on the form submitted for code compliance.

13-603.A.2 Door area determination. Door areas shall be determined from the measurements specified on the plans for each exterior and adjacent door.

All sliding glass doors and glass areas in doors shall be included in the glazing calculation and meet the requirements of Section 13-601 unless the glass is less than one-third of the area of the door.

SECTION 13-604
CEILINGS

13-604.ABC Mandatory requirements for Methods A, B and C.

13-604.ABC.1 Ceiling insulation. Ceilings shall have an insulation level of at least R-19, space permitting. For the purposes of this code, types of ceiling construction that are considered to have inadequate space to install R-19 include single assembly ceilings of the exposed deck and beam type and concrete deck roofs. Such ceiling assemblies shall be insulated to at least a level of R-10.

Ceiling insulation *R*-values claimed shall be in accordance with the criteria described in Section C1.2 of Appendix 13-C of this chapter.

13-604.ABC.1.1 Ceilings with blown-in insulation. Ceilings with a rise greater than 5 and a run of 12 (5 over 12 pitch) shall not be insulated with blown-in insulation. Blown-in (loose fill) insulation shall not be used in sections of attics where the distance from the top of the bottom chord of the trusses, ceiling joists or obstructions (such as air conditioning ducts) to the underside of the top chord of the trusses at the ridge is less than 30 inches (762 mm) or where the distance from any point of 30 inches (762 mm) minimum clearance out to the ceiling surface in the roof eave area that is to be insulated is greater than 10 feet (3048 mm).

13-604.ABC.1.1.1 Insulation dams. In every installation of blown-in (loose fill) insulation, insulation dams (for installations up to R-19 only); or insulation chutes, insulation baffles, or similar devices (for installations over R-19) shall be installed in such a manner so as to restrict insulation from blocking natural ventilation at the roof eave area to the attic space. Such devices shall be installed in spaces between all rafters of the roof structure and shall extend from the eave plate line to the attic area. In all cases, including the use of batt insulation, the insulation shall not be installed so as to block natural ventilation flow.

13-604.ABC.1.1.2 Reference marks. In that portion of the attic floor to receive blown insulation, reference marks or rules shall be placed within every 6 feet to 10 feet (1829 mm to 3048 mm) throughout the attic space. The reference marks shall show the height to which the insulation must be placed in order to meet the planned insulation level. Such marks shall be used by the building official to verify the claimed insulation level. The reference marks or rules may be placed on truss webs or other appropriate roof framing members. Each reference mark or rule shall be visible from at least one attic access point.

13-604.ABC.1.2 Common ceilings/floors. Wood, steel and concrete ceilings/floors common to separate conditioned tenancies shall be insulated to a minimum R-11, space permitting.

13-604.ABC.1.3 Roof decks over dropped ceiling plenum. Roof decks shall be insulated to R-19 if the space beneath it will be used as a plenum of the air distribution system. Plenums shall meet all criteria of Section 13-610.ABC.3.6.

13-604.ABC.2 Ceiling infiltration. Ceilings shall meet the minimum air infiltration requirements of Section 13-606.1.

13-604.A Requirements specific to Method A.

13-604.A.1 Ceiling types. Ceilings entered into the Fla/Res program shall be identified in sufficient detail for the building official to determine whether their characteristics are adequately represented on the form submitted for code compliance.

13-604.A.2 Walls considered ceiling area. Wall areas that separate conditioned living space from unconditioned attic space (such as attic knee walls, walls on cathedral ceilings, skylight chimney shafts, gambrel roofs, etc.) shall be considered ceiling area. Such areas shall be included in calculations of ceiling area and shall have a minimum insulation value of R-19.

13-604.A.3 Installation criteria for homes claiming the radiant barrier option. The radiant barrier or IRCC options may be claimed in the EnergyGauge USA Fla/Res computer program where the radiant barrier system is to be installed in one of the configurations depicted in Figure 13-604.A.3 and the following conditions are met:

1. It shall be fabricated over a ceiling insulated to a minimum of R-19 with conventional insulation and shall not be used as a means to achieve partial or whole compliance with the minimum attic insulation level of R-19 prescribed in Section 13-604.ABC.1. Either a sheet type or spray applied interior radiation control coating (IRCC) may be used.
2. If the radiant barrier material has only one surface with high reflectivity or low imessivity it shall be facing downward toward the ceiling insulation.
3. The attic airspace shall be vented in accordance with Section 2309.7 of the *Florida Building Code, Building*.
4. The radiant barrier system shall conform to ASTM C 1313, *Standard Specification for Sheet Radiant Barriers for Building Construction Applications*, or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction*, as appropriate for the type of radiant barrier to be installed. The operative surface shall have an emissivity not greater than 0.06 for sheet radiant barriers or 0.25 for interior radiation control coatings as demonstrated by independent laboratory testing according to ASTM C 1371.
5. The radiant barrier system (RBS) shall conform with ASTM C 1158, *Use and Installation of Radiant Barrier Systems (RBS) in Building Constructions for Sheet Radiant Barriers*, or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction*, for IRCC systems.
6. The radiant barrier shall be installed so as to cover gable ends without closing off any soffit, gable or roof ventilation.

13-604.A.4 Installation criteria for homes claiming the cool roof option. The cool roof option may be claimed in the EnergyGauge USA Fla/Res computer program where the roof to be installed has a tested solar reflectance of greater than 4 percent when evaluated in accordance with ASTM methods E-903, C-1549, E-1918 or CRRC Method #1. Emittance values provided by the roofing manufacturer in accordance with ASTM C 1371 shall be used when available. In cases where the appropriate data are not known, emittance shall be the same as the baseline home. Testing of a qualifying sample of the roofing material shall be performed by an approved independent laboratory with these results provided by the manufacturer.

13-604.B Requirements specific to Method B. All ceilings separating conditioned and unconditioned spaces shall be insulated to at least the minimum *R*-value given in Table 11B-1 of Form 1100B for the compliance package chosen.

13-604.C Requirements specific to Method C.

13-604.C.1 Additions. All roof/ceilings shall be insulated to the minimum *R*-value given on Table 11C-1 of Form 1100C for the type of construction used in the addition.

13-604.C.2 Renovations. Minimum insulation levels installed in renovated roofs/ceilings shall be not less than those specified in Section 13-604.C.1. These requirements apply only to roofs/ceilings that are being renovated.

SECTION 13-605
FLOORS

13-605.ABC Mandatory requirements for Methods A, B and C.

13-605.ABC.1 Floor Insulation. Insulation *R*-values claimed shall be in accordance with the criteria described in Section C1.2 of Appendix 13-C of this chapter.

13-605.ABC.1.1 Common floors. Wood, steel and concrete floors/ceilings common to two separate conditioned tenancies in multifamily applications shall be insulated to a minimum of R-11, space permitting.

13-605.ABC.1.2 Slab-on-grade. For insulated slab-on-grade floors, the exposed vertical edge of the slab shall be covered with exterior slab insulation extending from the top of the slab down to at least the finished grade level. Extending the insulation to the bottom of the footing or foundation wall is recommended.

13-605.ABC.2 Floor infiltration. Floors shall meet the minimum air infiltration requirements of Section 13-606.1.

13-605.A Requirements specific to Method A.

13-605.A.1 Floor types. Floors entered into the EnergyGauge USA Fla/Res program shall be identified in sufficient detail for the building official to determine whether their characteristics are adequately represented on the form submitted for code compliance.

13-605.B Requirements specific to Method B. All floors shall be insulated to the minimum R-value given on Table 11B-1 of Form 1100B.

13-605.C Requirements specific to Method C.

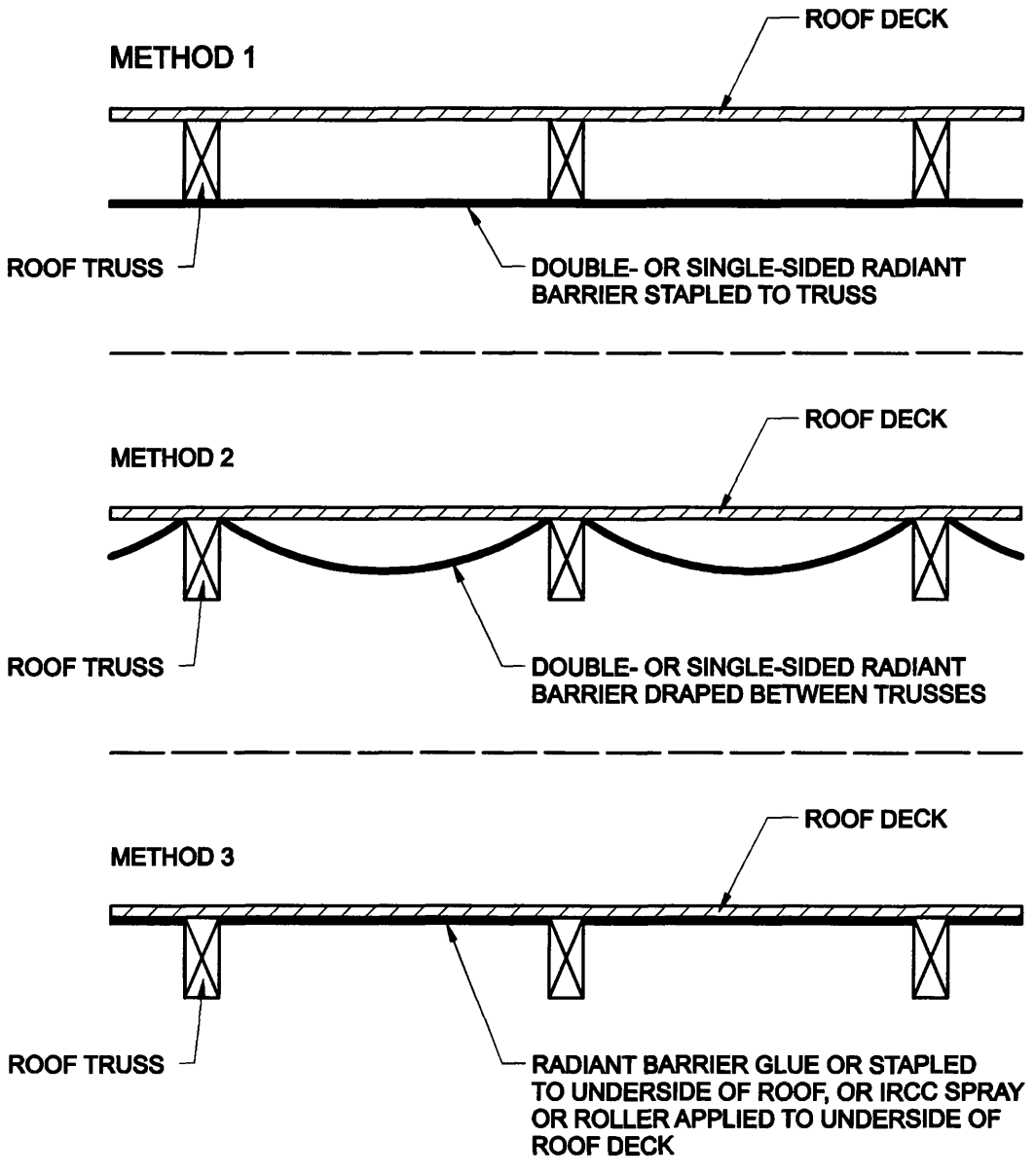


FIGURE 13-604.A.3
ACCEPTABLE ATTIC RADIANT BARRIER CONFIGURATIONS

13-605.C.1 Additions. All floors shall be insulated to the minimum *R*-value given on Table 11C-1 of Form 1100C for the type of construction used.

13-605.C.2 Renovations. Minimum insulation levels installed in renovated floors shall be not less than those specified on Table 11C-1 of Form 1100C for only the floors that are being renovated.

SECTION 13-606
AIR INFILTRATION

13-606.ABC Mandatory requirements for Methods A, B and C. Buildings shall be constructed and sealed in such a way as to prevent excess air infiltration.

Caution: Caution should be taken to limit the use of materials and systems which produce unusual or excessive levels of indoor air contaminants.

13-606.ABC.1 Infiltration levels allowed.

13-606.ABC.1.1 Exterior doors and windows. Exterior doors and windows shall be designed to limit air leakage into or from the building envelope. Manufactured doors and windows shall have air infiltration rates not exceeding those shown in Table 13-606.ABC.1.1. These rates shall be determined from tests conducted at a pressure differential of 1.567 pound per square foot (8 kg/m^2), which is equivalent to the impact pressure of a 25 mph wind. Compliance with the criteria of air leakage shall be determined by testing to AAMA/WDMA/101/I.S. 2 or ASTM E 283, as appropriate. Site-constructed doors and windows shall be sealed in accordance with Section 13-606.ABC.1.2.

TABLE 13-606.ABC.1.1
ALLOWABLE AIR INFILTRATION RATES

Frame Type	Windows (cfm per square foot of window area)	Doors (cfm per square foot of door area)	
		Sliding	Swinging
Wood	0.3	0.3	0.5
Aluminum	0.3	0.3	0.5
PVC	0.3	0.3	0.5

13-606.ABC.1.2 Exterior joints or openings in the envelope. Exterior joints, cracks, or openings in the building envelope that are sources of air leakage shall be caulked gasketed, weatherstripped or otherwise sealed in accordance with the criteria in Sections 13-606.ABC.1.2.1 through 13-606.ABC.1.2.5.

13-606.ABC.1.2.1 Exterior and adjacent walls. Exterior and adjacent walls shall be sealed at the following locations:

1. Between windows and doors and their frames;
2. Between windows and door frames and the surrounding wall;
3. Between the foundation and wall assembly sill-plates;
4. Joints between exterior wall panels at changes in plane, such as with exterior sheathing at corners and changes in orientation;
5. Openings and cracks around all penetrations through the wall envelope such as utility services and plumbing;
6. Between the wall panels and top and bottom plates in exterior and adjacent walls. In frame construction, the crack between exterior and adjacent wall bottom plates and floors shall be sealed with caulking or gasket material. Gypsum board or other wall paneling on the interior surface of exterior and adjacent walls shall be sealed to the floor; and
7. Between walls and floor where the floor penetrates the wall.
8. Log walls shall meet the criteria contained in Section 13-C3.4 of Appendix 13-C of this chapter.

Exception: As an alternative to Items 1 through 7 above for frame buildings, an infiltration barrier may be installed in the exterior and adjacent walls. The infiltration barrier shall provide a continuous air barrier from the foundation to the top plate of the ceiling of the house, and shall be sealed at the foundation, the top plate, at openings in the wall plane (windows, doors, etc.), and at the seams between sections of infiltration barrier material. When installed on the interior side of the walls, such as with insulated face panels with an infiltration barrier, the infiltration barrier shall be sealed at the foundation or subfloor.

13-606.ABC.1.2.2 Floors. Penetrations and openings in raised floors, greater than or equal to $^1/_8$ inch (3 mm) in the narrowest dimension, shall be sealed unless backed by truss or joist members against which there is a tight fit or a continuous air barrier.

Exception: Where an infiltration barrier is installed in the floor plane of a house with raised floors. The infiltration barrier shall create a continuous air barrier across the entire floor area, and shall be sealed at the perimeter, at openings in the floor plane (grilles, registers, crawl space accesses, plumbing penetrations, etc.), and at seams between sections of infiltration barrier material.

13-606.ABC.1.2.3 Ceilings. Ceilings shall be sealed at the following locations:

1. Between walls and ceilings.
2. At penetrations of the ceiling plane of the top floor of the building (such as chimneys, vent pipes, ceiling fixtures, registers, open shafts, or chases) so that air flow between the attic or unconditioned space and conditioned space is stopped.
3. Large openings, such as shafts, chases soffits, opening around chimneys, and dropped ceiling spaces (such as above kitchen cabinets, bath-

room vanities, shower stalls, and closets), shall be sealed with an airtight panel or sheeting material and sealed to adjacent top plates (or other framing members) so that a continuous air barrier separates the spaces below and above the ceiling plane.

4. Gaps between ceiling gypsum board and the top plate shall be sealed with a sealant to stop air flow between the attic and the interior of wall cavities.
5. The attic access hatch, if located in the conditioned space shall have an airtight seal.

Exception: Where an infiltration barrier is installed in the ceiling plane of the top floor of the house. The infiltration barrier shall: create a continuous air barrier across the entire ceiling plane, be continuous across the tops of interior and exterior walls, and be sealed at the perimeter, at openings in the ceiling plane (grilles, registers, attic accesses, plumbing penetrations, vent pipes, chimneys, etc.), and at seams between sections of infiltration barrier material.

13-606.ABC.1.2.4 Recessed lighting fixtures. Recessed lighting fixtures installed in ceilings that abut an attic space shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
2. Type IC or non-IC rated, installed inside a sealed box [minimum of $^1/_2$-inch-thick (12.7 mm)] gypsum wall board, preformed polymeric vapor barrier, or other air tight assembly manufactured for this purpose) and maintaining required clearances of not less than $^1/_2$-inch-thick (12.7 mm) from combustible material and not less than 3 inch (76 mm) from insulation material.
3. Type IC rated, with no more than 2.0 cfm (.00094 m^3/s) air movement from the conditioned space to the ceiling cavity when measured in accordance with ASTM E 283. The fixture shall be tested at 75 Pa and shall be labeled.

13-606.ABC.1.2.5 Multiple-story houses. In multiple-story houses, the perimeter of the floor cavity (created by joists or trusses between floors) shall have an air barrier to prevent air flow between this floor cavity and outdoors or buffer zones of the house (such as a space over the garage).

1. Air-tight panels, sheathing, or sheeting shall be installed at the perimeter of the floor cavity. The panels, sheathing, or sheeting material shall be sealed to the top plate of the lower wall and the bottom plate of the upper wall by mastic or other adhesive caulk, or otherwise bridge from the air barrier of the upper floor to the air barrier of the lower floor.
2. Joints between sections of panels, sheathing, or sheeting shall be sealed.
3. All fireplaces and wood stoves shall have flue dampers.

13-606.ABC.1.3 Additional infiltration requirements. The following additional requirements shall be met:

1. All exhaust fans vented to the outdoors shall have dampers. This does not apply to combustion devices with integral exhaust ductwork, which shall comply with the *Florida Building Code, Fuel Gas.*
2. All combustion space heaters, furnaces, and water heaters shall be provided with adequate combustion air. Such devices shall comply with NFPA or the locally adopted code.

   Caution: Caution should be taken to limit the use of materials and systems which produce unusual or excessive levels of indoor air contaminants.

13-606.ABC.1.4 Apertures or openings. Any apertures or openings in walls, ceilings or floors between conditioned and unconditioned space (such as exits in the case of hydrostatic openings in stairwells for coastal buildings) shall have dampers which limit air flow between the spaces.

13-606.A Requirements specific to Method A.

13-606.A.1 Infiltration loads. Infiltration loads shall be determined from the EnergyGauge USA Fla/Res computer program. Infiltration performance criteria shall be found in Section C3 in Appendix 13-C of this code.

13-606.A.2 Infiltration area. The area to be considered in the Infiltration calculation of Method A shall be the total conditioned floor area of the building.

SECTION 13-607
SPACE COOLING SYSTEMS

13-607.ABC Mandatory requirements For Methods A, B and C.

13-607.ABC.1 Equipment sizing. A cooling and heating load calculation shall be performed on the building and shall be attached to the Form 1100 submitted when application is made for a building permit, or in the event the mechanical permit is obtained at a later time, the calculation shall be submitted with the application for the mechanical permit. HVAC sizing calculations shall account for the directional orientation of the building for which the load is calculated; worst-case sizing calculations shall not be permitted. Cooling and heating design loads, for the purpose of sizing HVAC equipment and designing HVAC systems, shall be determined for the dwelling spaces (typically rooms or zones) served by each piece of equipment in accordance with ACCA Manual J, ACCA Manual N, or the ASHRAE *Cooling and Heating Load Calculation Manual.* This code does not allow designer safety factors, provisions for future expansion or

other factors which affect equipment sizing in excess of the capacity limitations in Section 13-607.ABC.1.1. System sizing calculations shall not include loads created by local intermittent mechanical ventilation such as standard kitchen and bathroom exhaust systems. The engineered ventilation requirement of the various procedures shall not be used as an infiltration rate when estimating infiltration loads.

Exceptions:

1. Where mechanical systems are designed by an engineer registered in the state of Florida, the engineer has the option of submitting a signed and sealed summary sheet in lieu of the complete sizing calculation(s). Such summary sheet shall include the following (by zone):
   Project name/owner
   Project Address
   Sizing Method Used
   Area in square feet
   Outdoor dry bulb used
   Total heating required with outside air
   Outdoor wet bulb used
   Total sensible gain
   Relative humidity
   Total latent gain
   Indoor dry bulb
   Total cooling required with outside air
   Grains water (difference)
2. Systems installed in existing buildings not meeting the definition of renovation in Section 13-202.

13-607.ABC.1.1 Cooling equipment capacity. Cooling only equipment shall be selected so that its total capacity is not less than the calculated total load but not more than 1.15 times greater than the total load calculated according to the procedure selected in Section 13-607.ABC.1, or the closest available size provided by the manufacturer's product lines. The corresponding latent capacity of the equipment shall not be less than the calculated latent load.

The published value for ARI total capacity is a nominal, rating-test value and shall not be used for equipment sizing. Manufacturer's expanded performance data shall be used to select cooling-only equipment. This selection shall be based on the outdoor design dry bulb temperature for the load calculation (or entering water temperature for water-source equipment), the blower CFM provided by the expanded performance data, the design value for entering wet bulb temperature and the design value for entering dry bulb temperature.

Design values for entering wet bulb and dry bulb temperature shall be for the indoor dry bulb and relative humidity used for the load calculation and shall be adjusted for return side gains if the return duct(s) is installed in an unconditioned space.

The manufacturer and model number of the outdoor and indoor units (if split system) shall be submitted along with the sensible and total cooling capacities at the design conditions described herein.

Exceptions:

1. Attached single- and multiple-family residential equipment sizing may be selected so that its cooling capacity is less than the calculated total load but not less than 80 percent of that load.
2. When signed and sealed by a Florida-registered engineer, in attached single- and multiple-family units, the capacity of equipment may be sized in accordance with good design practice.

13-607.ABC.1.2 Extra capacity required for special occasions. Residences requiring excess cooling or heating equipment capacity on an intermittent basis, such as anticipated additional loads caused by major entertainment events, shall have equipment sized or controlled to prevent continuous space cooling or heating within that space by one or more of the following options:

1. A separate cooling or heating system is utilized to provide cooling or heating to the major entertainment areas.
2. A variable capacity system sized for optimum performance during base load periods is utilized.

13-607.ABC.2 Controls. Each mechanical supply and exhaust ventilation system shall be equipped with a readily accessible switch or other means for shut off or volume reduction and shut off when ventilation is not required. Automatic or manual dampers installed for the purpose of shutting off ventilation systems shall be designed with tight shutoff characteristics to minimize air leakage.

Exception: Manual dampers for outdoor air intakes may be used for single-and multiple-family residential buildings or for fan system capacities of less than 5,000 cfm (2.4 m^3/s).

13-607.ABC.2.1 Zoning for temperature control. In one- and two-family dwellings, at least one thermostat for regulation of space temperature shall be provided for each separate HVAC system or zone.

13-607.ABC.2.2 Control setback and shutoff. The thermostat required in Section 13-607.ABC.2.1, or an alternate means including, but not limited to, a switch or clock, shall provide a readily accessible manual or automatic means for reducing the energy required for heating and cooling during periods of nonuse or reduced need including, but not limited to, unoccupied periods or sleeping hours.

13-607.ABC.2.3 Humidity control. Where a humidistat is used for comfort dehumidification, it shall be capable of being set to prevent the use of fossil fuel or electricity to reduce humidities below 60 percent.

13-607.ABC.3 Equipment performance standards.

13-607.ABC.3.1 Equipment ratings. Equipment efficiency ratings shall be obtained from a nationally recognized certification program directory, or from a manufacturer's rating certified to be in compliance with an approved Department of Energy (DOE) or Air-conditioning and Refrigeration Institute (ARI) rating procedure. Equipment efficiencies shall be based on the

standard rating conditions contained in the test standard referenced in Subchapter 13-3 that is appropriate for that equipment. The procedure for determining the integrated part-load value (IPLV) for a piece of equipment shall be the one provided in the appropriate ARI test standard for the type of equipment referenced. Minimum ratings for products covered under the National Appliance Energy Conservation Act of 1987 shall be those determined for Region IV and used for the Federal Trade Commission's required appliance labeling.

Cooling system efficiencies shall be rated as follows:

1. Central air conditioning equipment under 65,000 Btu/h (312 m^3/kw) capacity, both split-system and single-package equipment, single or three phase, shall be rated with a seasonal energy efficiency ratio (SEER).
2. Packaged terminal air conditioners and heat pumps shall be rated with an energy efficiency ratio (EER).
3. Room air conditioners shall be rated by an energy efficiency ratio (EER).
4. Central air conditioning equipment over 65,000 Btu/h (312 m^3/kw) shall be rated with an energy efficiency ratio (EER).
5. Water-cooled and evaporatively cooled central systems under 135,000 Btu/h (648m^3/kw) shall be rated with an energy efficiency ratio (EER).
6. Large capacity air-cooled, evaporatively- cooled and water source unitary air-conditioning systems may also be rated with an IPLV.
7. Heat-operated cooling equipment and gas-driven heat pumps shall be rated with a COP-cooling.

13-607.ABC.3.1.1 Equipment efficiency verification. Equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall comply with U.S. Department of Energy certification requirements. For other equipment, if a certification program exists for a product covered in Tables 13-607.ABC.3.2A through 13-607.ABC.3.2D, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be either listed in the certification program or, alternatively, the ratings shall be verified by an independent laboratory test report. If no certification program exists for a product covered in Tables 13-607.ABC.3.2A through 13-607.ABC.3.2D, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where components, such as indoor or outdoor coils, from different manufacturers are used, a Florida-registered engineer shall specify component efficiencies whose combined efficiency meets the minimum equipment efficiency requirements in Section 13-607.ABC.3.2.

13-607.ABC.3.2 Minimum efficiencies for cooling equipment. Equipment shown in Tables 13-607.ABC.3.2A, 13-607.ABC.3.2B and 13-607.ABC.3.2D shall meet the minimum performance for that equipment at the specified rating conditions when tested in accordance with the specified test procedure. Omission of minimum performance requirements for equipment not listed in Tables 13-607.ABC.3.2A, 13-607.ABC.3.2B and 13-607.ABC.3.2.D does not preclude use of such equipment. Equipment not listed in Tables 13-607.ABC.3.2A, 13-607.ABC.3.2B and 13-607.ABC.3.2D has no minimum performance requirements. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements, unless otherwise exempted by_footnotes in the table. However, equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum efficiency requirements for operation at minimum capacity or other than standard rating conditions. Equipment used to provide water heating functions as part of a combination system shall satisfy all stated requirements for the appropriate space heating or cooling category.

Tables 13-607.ABC.3.2A, 13-607.ABC.3.2B and 13-607.ABC.3.2D contain the minimum efficiency requirements for equipment covered by this section of the code. The tables are organized to cover the following types of equipment:

Table 13-607.ABC.3.2A, Air Conditioners and Condensing Units.

Table 13-607.ABC.3.2B, Heat Pumps.

Table 13-607.ABC.3.2D, Packaged Terminal and Room Air Conditioners and Heat Pumps.

Exception: Existing mechanical systems undergoing alteration need not meet the minimum equipment efficiencies of this section except to preserve the original approval or listing of the equipment.

Where water chillers and cooling towers are installed in residential buildings complying by this subchater, minimum efficiency ratings shall be as found in Table 13-407.ABC.3.3C and Tables 13-407.ABC.3.2G through 13-407.ABC.3.2J.

13-607.A Prescriptive requirements specific to Method A.

13-607.A.1 Cooling systems. The impact of cooling system efficiency in the energy performance calculation shall be determined for air conditioners based on the appropriate efficiency rating for the system to be installed from the EnergyGauge USA Fla/Res computer program.

13-607.A.2 Additions. Space cooling may be provided by existing or newly installed equipment. Systems in operation before the construction of the addition shall be considered existing systems and shall comply with criteria in Section 13-600.A.5.2.1. New systems may be replacements of existing equipment or equipment installed to condition only the addition.

13-607.B Requirements specific to Method B. Houses complying by Method B shall meet the following cooling equipment efficiencies:

1. All central cooling systems of less than 65,000 Btu/h capacity shall have a SEER equal to or greater than the prescribed value on Table 11B-1 of Form 1100B.

TABLE 13-607.ABC.3.2A
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[2]	Test Procedure[1]
Air Conditioners, Air Cooled	<65,000 Btu/h[3]	All	Split System	13.0 SEER	ARI 210/240
			Single Package	13.0 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.3 EER	
		All other	Split System and Single Package	10.1 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.7 EER	ARI 340/360
		All other	Split System and Single Package	9.5 EER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER ,9.7 IPLV	
		All other	Split System and Single Package	9.3 EER,9.5 IPLV	
	>760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.2 EER, 9.4 IPLV	
		All other	Split System and Single Package	9.0 EER, 9.2 IPLV	
Through-the-Wall, Air Cooled	<30,000 Btu/h[3]	All	Split System	10.9 SEER	ARI 210/240
			Single Package	10.6 SEER	
Small-Duct High-Velocity, Air Cooled	<65,000 Btu/h[3]	All	Split System or Single Package	11.0 SEER[4]	ARI 210/240
Space Constrained Products, Air Conditioners	<65,000 Btu/h[3]	All	Split System or Single Package	12.0 SEER	ARI 210/240
Air Conditioners, Water and Evaporatively Cooled	<65,000 Btu/h	All	Split System and Single Package	12.1 EER	ARI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.5 EER	
		All other	Split System and Single Package	11.3 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER	ARI 340/360
		All other	Split System and Single Package	10.8 EER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER, 10.3 IPLV	
		All other	Split System and Single Package	10.8 EER, 10.1 IPLV	
Condensing Units, Air Cooled	≥135,000 Btu/h			10.1 EER, 11.2 IPLV	ARI 365
Condensing Units, Water or Evaporatively Cooled	≥135,000 Btu/h			13.1 EER,13.1 IPLV	

For SI: 1 Btu/h = .2931 W.

1. Subchapter 13-3 contains a complete specification of the reference test procedure, including the referenced year version of the test procedure.
2. IPLVs are only applicable to equipment with capacity modulation.
3. Single-phase, air-cooled air-conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.
4. As granted by U.S. Department of Energy letter of exception, specific to individual companies. SDHV products without a letter of exception shall have the same efficiency as air-cooled air conditioners.

TABLE 13-607.ABC.3.2B
ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[2]	Test Procedure[1]
Air Cooled (Cooling Mode)	<65,000 Btu/h[3]	All	Split System	13.0 SEER	ARI 210/240
			Single Package	13.0 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.1 EER	
		All other	Split System and Single Package	9.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.3 EER	ARI 340/360
		All other	Split System and Single Package	9.1 EER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.0 EER 9.2 IPLV	
		All other	Split System and Single Package	8.8 EER 9.0 IPLV	
Through-the-Wall, Air Cooled	<30,000 Btu/h[3]	All	Split System	10.9 SEER	ARI 210/240
			Single Package	10.6 SEER	
Small-Duct High-Velocity, Air Cooled, Cooling Mode	<65,000 Btu/h[3]	All	Split System	11.0 SEER[4]	ARI 210/240
Water Source (Cooling Mode)	<17,000 Btu/h	All	86°F Entering Water	11.2 EER	ISO-13256-1
	≥17,000 Btu/h and <135,000 Btu/h	All	86°F Entering Water	12.0 EER	
Groundwater Source (Cooling Mode)	<135,000 Btu/h	All	59°F Entering Water	16.2 EER	
Ground Source (Cooling Mode)	<135,000 Btu/h	All	77°F Entering Water	13.4 EER	
Air Cooled (Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity)		Split System	7.7 HSPF	ARI 210/240
			Single Package	7.7 HSPF	
	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)		47°F db/43°F wb Outdoor Air 17°F db/15°F wb Outdoor Air	3.2 COP 2.2 COP	
	≥135,000 Btu/h (Cooling Capacity)		47°F db/43°F wb Outdoor Air 17°F db/15°F wb Outdoor Air	3.1 COP 2.0 COP	ARI 340/360
Through-the-Wall (Air Cooled, Heating Mode)	<30,000 Btu/h[3] (Cooling Capacity)		Split System	7.1 HSPF	ARI 210/240
			Single Package	7.0 HSPF	
Small-Duct High-Velocity (Air Cooled, Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity)		Split System or Single Package	6.8 HSPF[4]	ARI 210/240
Space Constrained Products, Heat Pumps	<65,000Btu/h[3]		Split System or Single Package	7.4 HSPF	ARI 210/240
Water-Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		68°F Entering Water	4.2 COP	ISO-13256-1
Groundwater Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		50°F Entering Water	3.6 COP	
Ground Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		32°F Entering Water	3.1 COP	

For SI: 1 Btu/h = .2931W,
°C = [(°F) - 32]/1.8

1. Subchapter 13-3 contains a complete specification of the reference test procedure, including the referenced year version of the test procedure.
2. IPLVs and Part Load rating conditions are only applicable to equipment with capacity modulation.
3. Single-phase, air-cooled heat pumps <65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.

TABLE 13-607.ABC.3.2D
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE-PACKAGE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS, AND ROOM AIR CONDITIONERS HEAT PUMPS — MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
PTAC (Cooling Mode), New Construction	7,000 ≥Btu/h <8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 12.5 – (0.213 x Cap/1000)] [3]	11.0 EER	ARI 310/380
	8,000 ≤Btu/h < 9,000		10.8 EER	
	9,000 ≤Btu/h < 10,000		10.6 EER	
	10,000 ≤Btu/h < 11,000		10.4 EER	
	11,000 ≤Btu/h < 12,000		10.2 EER	
	12,000 ≤Btu/h < 13,000		9.9 EER	
	13,000 ≤Btu/h < 14,000		9.7 EER	
	14,000 ≤Btu/h < 15,000		9.5 EER	
	>15,000 Btu/h		9.3 EER	
PTAC (Cooling Mode), Replacements[2]	7,000 ≥Btu/h <8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 10.9 – (0.213 x Cap/1000)] [3]	9.4 EER	
	8,000 ≤Btu/h < 9,000		9.2 EER	
	9,000 ≤Btu/h < 10,000		9.0 EER	
	10,000 ≤Btu/h < 11,000		8.8 EER	
	11,000 ≤Btu/h < 12,000		8.6 EER	
	12,000 ≤Btu/h < 13,000		8.3 EER	
	13,000 ≤Btu/h < 14,000		8.1 EER	
	14,000 ≤Btu/h < 15,000		7.9 EER	
	>15,000 Btu/h		7.7 EER	
PTHP (Cooling Mode), New Construction	7,000 ≥Btu/h <8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 12.3 – (0.213 x Cap/1000)] [3]	10.8 EER	
	8,000 ≤Btu/h < 9,000		10.6 EER	
	9,000 ≤Btu/h < 10,000		10.4 EER	
	10,000 ≤Btu/h < 11,000		10.2 EER	
	11,000 ≤Btu/h < 12,000		10.0 EER	
	12,000 ≤Btu/h < 13,000		9.7 EER	
	13,000 ≤Btu/h < 14,000		9.5 EER	
	14,000 ≤Btu/h < 15,000		9.3 EER	
	>15,000 Btu/h		9.1 EER	
PTHP (Cooling Mode), Replacements[2]	7,000 ≥Btu/h <8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 10.8 – (0.213 x Cap/1000)] [3]	9.3 EER	
	8,000 ≤Btu/h < 9,000		9.1 EER	
	9,000 ≤Btu/h < 10,000		8.9 EER	
	10,000 ≤Btu/h < 11,000		8.7 EER	
	11,000 ≤Btu/h < 12,000		8.5 EER	
	12,000 ≤Btu/h < 13,000		8.2 EER	
	13,000 ≤Btu/h < 14,000		8.0 EER	
	14,000 ≤Btu/h < 15,000		7.8 EER	
	>15,000 Btu/h		7.6 EER	
PTHP (Heating Mode), New Construction	7,000 ≥Btu/h <8,000	47°F db Outdoor Air [Based on capacity at lower range using COP= 3.2 – (0.026 x Cap/1000)] [3]	3.02 COP	
	8,000 ≤Btu/h < 9,000		2.99 COP	
	9,000 ≤Btu/h < 10,000		2.97 COP	
	10,000 ≤Btu/h < 11,000		2.94 COP	
	11,000 ≤Btu/h < 12,000		2.91 COP	
	12,000 ≤Btu/h < 13,000		2.89 COP	
	13,000 ≤Btu/h < 14,000		2.86 COP	
	14,000 ≤Btu/h < 15,000		2.84 COP	
	>15,000 Btu/h		2.81 COP	
PTHP (Heating Mode), Replacements[2]	7,000 ≥Btu/h <8,000	47°F db Outdoor Air [Based on capacity at lower range using COP= 2.9 – (0.026 x Cap/1000)] [3]	2.72 COP	
	8,000 ≤Btu/h < 9,000		2.69 COP	
	9,000 ≤Btu/h < 10,000		2.67 COP	
	10,000 ≤Btu/h < 11,000		2.64 COP	
	11,000 ≤Btu/h < 12,000		2.61 COP	
	12,000 ≤Btu/h < 13,000		2.59 COP	
	13,000 ≤Btu/h < 14,000		2.56 COP	
	14,000 ≤Btu/h < 15,000		2.54 COP	
	>15,000 Btu/h		2.51 COP	

(continued)

TABLE 13-607.ABC.3.2D - continued
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE-PACKAGE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS, AND ROOM AIR CONDITIONERS HEAT PUMPS — MINIMUM EFFICIENCY REQUIREMENTS

SPVAC (Cooling Mode)	All Capacities	95°F db/75°F wb Outdoor Air	8.6 EER	ARI 390
SPVHP (Cooling Mode)	All Capacities	95°F db/75°F wb Outdoor Air	8.6 EER	
SPVHP (Heating Mode)	All Capacities	47°F db/43°F wb Outdoor Air	2.7 COP	
Room Air Conditioners with Louvered Sides	8,000 <Btu/h		9.7 EER	ANSI/AH AM RAC-1
	>8,000 <14,000 Btu/h		9.8 EER	
	>14,000 <20,000 Btu/h		9.7 EER	
	>20,000 Btu/h		8.5 EER	
Room Air Conditioners, without Louvered Sides	<8,000 Btu/h		9.0 EER	
	>8,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps with Louvered Sides	<20,000 Btu/h		9.0 EER	
	>20,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps without Louvered Sides	<14,000 Btu/h		8.5 EER	
	>14,000 Btu/h		8.0 EER	
Room Air Conditioner, Casement only	All Capacities		8.7 EER	
Room Air Conditioner, Casement-Slider	All Capacities		9.5 EER	

For SI: 1Btu/h = .2931W, °C = [(°F) - 32]/1.8

1. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
2. Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) high and less than 42 inches (1067 mm) wide.
3. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

2. Packaged terminal air conditioners (PTACs), packaged terminal heat pumps (PTHPs), room air conditioners, and equipment not covered by U.S. Department of Energy (DOE) rules shall have an EER equal to the prescribed SEER level on Table 11B-1 of Form 1100B.

13-607.B.1 Additions. Where cooling equipment is to be installed in an addition, the requirements of Section 13-607.B shall be met only when equipment is installed to specifically serve the addition or is being installed in conjunction with the construction of the addition.

13-607.C Requirements specific to Method C.

13-607.C.1 Additions. All new air conditioners installed in additions complying by Method C shall meet the minimum efficiencies in Section 13-607.ABC.3.2.

Minimum equipment efficiencies shall be met only when equipment is installed to specifically serve the addition or is being installed in conjunction with the construction of the addition.

13-607.C.2 Renovations. Minimum efficiencies for cooling equipment to be added or replaced in renovations shall not be less than those specified in Section 13-607.ABC.3.2.

13-607.C.3 Manufactured homes and manufactured buildings. Minimum efficiencies for site-installed cooling equipment in manufactured homes shall not be less than those specified in Section 13-607.ABC.3.2.

13-607.C.4 Building systems. Newly manufactured cooling systems installed in existing buildings shall meet minimum requirements for that system in Section 13-607.ABC (see also Section 13-101.6).

SECTION 13-608
SPACE HEATING SYSTEMS

13-608.ABC Mandatory requirements for Methods A, B, and C.

13-608.ABC.1 Equipment sizing. An HVAC equipment sizing calculation shall be performed on the building in accordance with the criteria in Section 13-607.ABC.1 and shall be attached to the Form 1100 submitted when application is made for a building permit. This code does not allow designer safety factors, provisions for future expansion or other factors which affect equipment sizing in excess of the capacity limitations in Sections 13-608.ABC.1.1 through 13-608.ABC.1.4. System sizing calculations shall not include loads due to intermittent local mechanical ventilation such as standard kitchen and bathroom exhaust systems. The engineered ventilation requirement of this code shall not be used as an infiltration rate when estimating infiltration load.

13-608.ABC.1.1 Heat pumps. Heat pump sizing shall be based on the cooling requirements as calculated according to Section 13-607.ABC.1 and the heat pump total cooling capacity shall not be more than 1.15 times greater than the design cooling load even if the design heating load is 1.15 times greater than the design cooling load. The published value for ARI total capacity is a nominal, rating-test value and shall not be used for equipment sizing. Manufacturer's expanded performance data shall not be used to determine heat pump cooling capacity. This selection shall be based on the outdoor design dry bulb temperature for the load calculation (or entering water temperature for water-source equipment), the blower CFM provided by the expanded performance data, the design value for entering wet bulb temperature and the design value for entering dry bulb temperature.

The design values for entering wet bulb temperature shall be for the indoor dry bulb and relative humidity used for the load calculation and shall be adjusted for return side gains if the return duct(s) is installed in an unconditioned space.

Capacity at the design heating temperature may be determined by interpolation or extrapolation of manufacturers' performance data, as allowed by the manufacturer, if these data are not available for the design temperature. The auxiliary capacity plus refrigeration cycle heating capacity shall not exceed 120 percent of the calculated heating requirements at the 99-percent design dry bulb temperature.

The manufacturer and model number of the outdoor and indoor units (if split system) shall be submitted along with the sensible and total cooling capacities at the design conditions described herein.

13-608.ABC.1.2 Electric resistance furnaces. Electric resistance furnaces shall be sized within 4 kW of the design requirements calculated according to the procedure selected in Section 13-607.ABC.1.

13-608.ABC.1.3 Fossil fuel heating equipment. The capacity of fossil fuel heating equipment with natural draft atmospheric burners shall not be less than the design load calculated in accordance with Section 13-608.ABC.1.

13-608.ABC.1.4 Extra capacity required for special occasions. Residences requiring excess heating capacity on an intermittent basis shall comply with Section 13-607.ABC.1.2.

13-608.ABC.2 Controls. Requirements specified for controls in Section 13-607.ABC.2 shall apply for space heating systems. Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

13-608.ABC.2.1 Heat pump auxiliary heat control. Heat pumps equipped with internal electric-resistance heaters shall have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during outdoor coil defrost cycles. Two means of meeting this requirement are (1) a digital or electronic thermostat designed for heat pump use that energizes auxiliary heat only when the heat pump has insufficient capacity to maintain setpoint or to warm up the space at a sufficient rate, or (2) a multistage space thermostat and an outdoor air thermostat wired to energize auxiliary

heat only on the last stage of the space thermostat and when outside air temperature is less than 40°F (4°C).

Exception: Heat pumps whose minimum efficiency is regulated by NAECA and whose HSPF rating both meets the requirements shown in Table 13-607.ABC.3.2B and includes all usage of internal electric resistance heating.

13-608.ABC.3 Equipment performance standards.

13-608.ABC.3.1 Equipment ratings. Equipment efficiency ratings shall be obtained from a nationally recognized certification program directory, from a manufacturer's rating certified to be in compliance with an approved Department of Energy (DOE) or Air-conditioning and Refrigeration Institute (ARI) rating procedure. Equipment efficiencies shall be based on the standard rating conditions contained in the test standard referenced in Subchapter 13-3 that is appropriate for that equipment. Minimum ratings for products covered under the National Appliance Energy Conservation Act of 1987 shall be those determined for Region IV and used for the Federal Trade Commission's required appliance labeling.

13-608.ABC.3.1.1 Mix-matched equipment. Ratings for unitary central heat pump systems less than 65,000 Btu/h, using evaporator/(condenser) coils manufactured by independent companies, shall meet all requirements of Section 13-607.ABC.3.1.1.

13-608.ABC.3.2 Minimum efficiencies for heating equipment. Tables 13-607.ABC.3.2B, 13-607.ABC.3.2D, and 13-608.ABC.3.2E through 13-608.ABC.3.2F contain the minimum efficiency requirements for equipment covered by this section of the code. The tables are organized to cover the following types of equipment:

Table 13-607.ABC.3.2B, Heat Pumps.

Table 13-607.ABC.3.2D, Packaged Terminal Air Conditioners and Heat Pumps.

Table 13-608.ABC.3.2E, Furnaces, Duct Furnaces and Unit Heaters.

Table 13-608.ABC.3.2F, Gas- and Oil-Fired Boilers.

13-608.ABC.3.2.1 Gas- and oil-fired furnaces. Gas-fired and oil-fired forced air furnaces with input ratings >225,000 Btu/h shall also have an intermittent ignition or interrupted device (IID) and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings >225,000 Btu/h, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input.

13-608.ABC.3.2.2 Central electric furnaces. Central electric furnaces greater than 10 kW shall be divided into at least two stages and controlled by an outdoor thermostat, multistage indoor thermostat, or combinations thereof.

13-608.A Requirements specific to Method A.

13-608.A.1 Heating systems. The impact of heating system efficiency in the energy performance calculation shall be determined for the type of heating system to be installed based on its efficiency rating from the EnergyGauge USA Fla/Res computer program.

13-608.A.2 Additions. Space heating may be provided by existing or newly installed equipment. Systems in operation before the construction of the addition shall be considered existing systems. New systems may be replacements of existing equipment or equipment installed to condition only the addition.

TABLE 13-608.ABC.3.2E
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS. MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Warm Air Furnace, Gas-Fired	<225,000 Btu/h		78% AFUE or ;80% E_t[4]	DOE 10 CFR, Part 430 or ANSI Z 21.47
	≥225,000 Btu/h	Maximum Capacity[4]	80% E_c[3]	ANSI Z21.47
Warm Air Furnace, Oil-Fired	<225,000 Btu/h		78% AFUE or ;80% E_t[4]	DOE 10 CFR, Part 430 or UL 727
	≥225,000 Btu/h	Maximum Capacity[5]	81% E_t[6]	UL 727
Warm Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity[5]	80% E_c[7]	ANSI Z83.8
Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity[5]	80% E_c[7]	ANSI Z83.8
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity[5]	80% E_c[7]	UL 731

For SI: 1 Btu/h = .2931 W.

1. E_t = thermal efficiency. See test procedure for detailed discussion.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. E_c = combustion efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
4. Combination units not covered by NAECA (three-phase power or cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating.
5. Minimum and maximum ratings as provided for and allowed by the unit's controls.
6. E_t = thermal efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
7. E_c = combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

TABLE 13-608.ABC.3.2F
GAS- AND OIL-FIRED BOILERS MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type[4]	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Boilers, Gas-Fired	<300,000 Btu/h	Hot water	80% AFUE	DOE 10 CFR Part 430
		Steam	75% AFUE	
	≥300,000 Btu/h and <2,500,000	Maximum Capacity[3]	75% E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	80% E_c	
	>2,500,000 Btu/h[4]	Steam	80% E_c	
Boilers, Oil-Fired	<300,000 Btu/h		80% AFUE	DOE 10 CFR Part 430
	≥300,000 Btu/h and ≤250,000,000 Btu/h	Maximum Capacity[3]	78% E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	83% E_c	
	>2,500,000 Btu/h[4]	Steam	83% E_c	
Oil-Fired (Residual)	≥300,000 Btu/h and ≤250,000,000 Btu/h	Maximum Capacity[3]	78% E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	83% E_c	
	>2,500,000 Btu/h[4]	Steam	83% E_c	

For SI: 1 Btu/h = .2931 W.

1. E_t = thermal efficiency. See reference documents for detailed information.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. Minimum and maximum ratings as provided for and allowed by the unit's controls.
4. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all package boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.

13-608.B Requirements specific to Method B. Space heating systems are categorized as electric or gas and oil. Heating equipment shall meet the applicable minimum efficiencies listed on Table 11B-1 of Form 1100B. Where heating equipment is to be installed in an addition, these requirements shall be met only when equipment is installed to specifically serve the addition or is being installed in conjunction with the construction of the addition.

13-608.B.1 Electric space heating. Electric resistance heating systems shall not be used when complying by Method B.

13-608.B.2 Gas, oil and instantaneous (tankless) water heaters used for space heating. Gas and oil heating systems may be installed. Gas instantaneous (tankless) water heaters that meet the requirements established for such equipment by this code may be installed.

13-608.C Requirements specific to Method C.

13-608.C.1 Additions. New heating equipment to be added or replaced in small additions complying by Method C shall meet the minimum efficiencies in Section 13-608.ABC.3.2. Minimum equipment efficiencies shall be met only when equipment is installed to specifically serve the addition or is being installed in conjunction with the construction of the addition.

13-608.C.2 Renovations. Minimum efficiencies for heating equipment to be added or replaced in renovations shall not be less than those specified in Section 13-608.ABC.3.2.

13-608.C.3 Manufactured homes and manufactured buildings. Minimum efficiencies for site-installed heating equipment in manufactured homes shall not be less than those specified in Section 13-608.ABC.3.2.

13-608.C.4 Building systems. Newly manufactured heating systems installed in existing buildings shall meet the minimum requirements for that system in Section 13-608.ABC (see Section 13-101.6 for exceptions).

SECTION 13-609
VENTILATION SYSTEMS

13-609.ABC Mandatory requirements for Methods A, B and C.

13-609.ABC.1 Buildings operated at positive indoor pressure. Residential buildings designed to be operated at a positive indoor pressure or for mechanical ventilation shall meet the following criteria:

1. The design air change per hour minimums for residential buildings in ASHRAE 62, *Ventilation for Acceptable Indoor Air Quality*, shall be the maximum rates allowed for residential applications.
2. No ventilation or air-conditioning system make-up air shall be provided to conditioned space from attics, crawl spaces, attached enclosed garages or outdoor spaces adjacent to swimming pools or spas.
3. If ventilation air is drawn from enclosed space(s), then the walls of the space(s) from which air is drawn shall be insulated to a minimum of R-11 and the ceiling shall be insulated to a minimum of R-19, space permitting, or R-10 otherwise.

SECTION 13-610
AIR DISTRIBUTION SYSTEMS

13-610.ABC Mandatory requirements for Methods A, B and C.

13-610.ABC.1 Air distribution system sizing and design. All air distribution systems shall be sized and designed in accordance with recognized engineering standards such as ACCA Manual D or other standards based on the following:

1. Calculation of the supply air for each room shall be based on the greater of the heating load or sensible cooling load for that room.
2. Duct size shall be determined by the supply air requirements of each room, the available static pressure and the total equivalent length of the various duct runs.
3. Friction loss data shall correspond to the type of material used in duct construction.

13-610.ABC.2 Air distribution system insulation requirements. All air distribution system components which move or contain conditioned air, including but not limited to, air filter enclosures, air ducts and plenums located in or on buildings shall be thermally insulated in accordance with the requirements of Sections 13-610.ABC.2.1 through 13-610.ABC.2.3.

13-610.ABC.2.1 Insulation required. The minimum installed thermal resistance (*R*-value) for air distribution system components shall be as specified in Table 13-610.ABC.2.1.

Exception: Air distribution system component insulation (except where required to prevent condensation) is not required in the following cases:

1. Within conditioned space.
2. Exhaust air ducts.
3. Factory-installed plenums, casings, or ductwork furnished as a part of HVAC equipment tested and rated in accordance with Section 13-607.ABC.3 or 13-608.ABC.3.

TABLE 13-610.ABC.2.1
MINIMUM INSULATION LEVELS
AIR DISTRIBUTION SYSTEM COMPONENTS[1]

Location	*R*-Value
On roof	R-6
Exterior of building	R-6
Attic with ceiling insulation	R-6
Between conditioned floors[2]	R-4.2
Enclosed attached garages	R-4.2
Unconditioned basement	R-4.2
Vented crawlspace	R-4.2

1. See Section 13-610.ABC.3.5, Air-handling units.
2. Except where perimeter walls to the between floor space are insulated.

13-610.ABC.2.2 *R*-value determination. All duct insulation and factory-made ducts shall be labeled with *R*-values based on flat sections of insulation only at installed thickness and excluding any air film resistance. The thermal resistance (R) shall be determined using the relationship $R = t/k$ where t (inches) is the installed thickness and k (Btu-in/hr·ft²°F) is the measured apparent thermal conductivity at 75°F (24°C) mean temperature and at installed thickness tested in accordance with ASTM C 518 or ASTM C 177.

The installed thickness of duct insulation used to calculate *R*-values shall be determined as follows:

1. Duct board, duct liner and factory-made rigid ducts not normally subjected to compression shall use the nominal insulation thickness.
2. Duct wrap shall have an assumed installed thickness of 75 percent of nominal thickness (25-percent compression).
3. Factory-made flexible air ducts shall have the installed thickness and calculated *R*-values determined in accordance with Paragraph 3.4 of the ADC Standard, *Flexible Duct Performance & Installation Standards.*

13-610.ABC.2.3 Condensation control. Additional insulation with vapor barrier shall be provided where the minimum duct insulation requirements of Section 13-610.ABC.2 are determined to be insufficient to prevent condensation.

13-610.ABC.2.4 Fibrous glass duct liner. Fibrous glass duct liner shall be fabricated and installed in accordance with the provisions of the NAIMA *Fibrous Glass Duct Liner Standard.*

13-610.ABC.3 Air distribution system construction and installation. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability. All transverse joints, longitudinal seams and fitting connections shall be securely fastened and sealed in accordance with the applicable standards of this section.

13-610.ABC.3.0 General. All enclosures which form the primary air containment passageways for air distribution systems shall be considered ducts or plenum chambers and shall be constructed and sealed in accordance with the applicable criteria of this section.

13-610.ABC.3.0.1 Mechanical fastening. All joints between sections of air ducts and plenums, between intermediate and terminal fittings and other components of air distribution systems, and between subsections of these components shall be mechanically fastened to secure the sections independently of the closure system(s).

13-610.ABC.3.0.2 Sealing. Air distribution system components shall be sealed with approved closure systems.

13-610.ABC.3.0.3 Space provided. Sufficient space shall be provided adjacent to all mechanical components located in or forming a part of the air distribution system to assure adequate access for: (1) construction and sealing in accordance with the requirements of Section 13-610.ABC.3 of this code; (2) inspection; and (3) cleaning and maintenance. A minimum of 4 inches (102 mm) is considered sufficient space around air-handling units.

Exception: Retrofit or replacement units not part of a renovation are exempt from the minimum clearance requirement.

13-610.ABC.3.0.4 Product application. Closure products shall be applied to the air barriers of air distribution system components being joined in order to form a continuous barrier or they may be applied in accordance with the manufacturer's instructions or appropriate industry installation standard where more restrictive.

13-610.ABC.3.0.5 Surface preparation. The surfaces upon which closure products are to be applied shall be clean and dry in accordance with the manufacturer's installation instructions.

13-610.ABC.3.0.6 Approved mechanical attachments. Approved mechanical attachments for air distribution system components include screws, rivets, welds, interlocking joints crimped and rolled, staples, twist in (screw attachment), and compression systems created by bend tabs or screw tabs and flanges or by clinching straps. Mechanical attachments shall be selected to be appropriate to the duct system type.

13-610.ABC.3.0.7 Approved closure systems. The following closure systems and materials are approved for air distribution construction and sealing for the applications and pressure classes prescribed in Sections 13-610.ABC.3.1 through 13-610.ABC.3.8:

1. Metal closures.
   a. Welds applied continuously along metal seams or joints through which air could leak.
   b. Snaplock seams, and grooved, standing, double-corner, single-corner and Pittsburgh-lock seams, as defined by SMACNA, as well as all other rolled mechanical seams. All seams shall be rolled or crimped
2. Gasketing, which achieves a 25/50 flame spread/smoke- density-development rating under ASTM E 84 or UL 723, provided that it is used only between mated surfaces which are mechanically fastened with sufficient force to compress the gasket and to fill all voids and cracks through which air leakage would otherwise occur.
3. Mastic closures. Mastics shall be placed over the entire joint between mated surfaces. Mastics shall not be diluted. Approved mastics include the following:
   a. Mastic or mastic-plus-embedded fabric systems applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part III.
   b. Mastic or mastic-plus-embedded fabric systems applied to nonmetal flexible duct that are listed and labeled in accordance with UL 181B, Part II.
   c. Mastic ribbons, which achieve a 25/50 flame spread/smoke density development rating under ASTM E 84 or UL 723, provided that they may be used only in flange-joints and lap-joints, such that the mastic resides between two parallel surfaces of the air barrier and that those surfaces are mechanically fastened.
4. Tapes. Tapes shall be applied such that they extend not less than 1 inch onto each of the mated surfaces and shall totally cover the joint. When used on rectangular ducts, tapes shall be used only on joints between parallel rigid surfaces and on right angle joints. Approved tapes include the following:
   a. Pressure-sensitive tapes.
      1) Pressure-sensitive tapes applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part I.
      2) Pressure-sensitive tapes applied to nonmetal flexible duct that are listed and labeled in accordance with UL 181B, Part I.
   b. Heat-activated tapes applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part II.
5. Aerosol sealant. Such sealants shall be installed by manufacturer-certified installers following manufacturer instructions and shall achieve 25/50 flame spread/smoke-density-development ratings under ASTM E 84 or UL 723.

13-610.ABC.3.1 Metal duct, rigid and flexible. All transverse joints, longitudinal seams and duct wall penetration of ducts and joints with other air distribution system components shall be mechanically attached and sealed using approved closure systems for that pressure class specified in Section 13-610.ABC.3.1.1 or Section 13-610.ABC.3.1.2.

13-610.ABC.3.1.1 Pressures less than 1-inch water gauge, approved closure systems. The following closure systems are approved for rigid metal duct designed to be operated at pressures less than 1-inch w.g. when they conform to the approved closure and mechanical attachment requirements of Section 13-610.ABC.3.0:

1. Continuous welds.
2. Snaplock seams, and grooved, standing, double-corner, single-corner and Pittsburgh-lock seams and all other rolled mechanical seams.
3. Mastic, mastic-plus-embedded fabric, or mastic ribbons.
4. Gaskets.
5. Pressure-sensitive tape.

13-610.ABC.3.1.2 Pressures 1-inch water gauge or greater, approved closure systems. The following closure systems are approved for rigid metal duct de-

signed to be operated at pressures 1-inch w.g. or greater and flexible duct when they conform to the approved closure and mechanical attachment requirements of Section 13-610.ABC.3.0:

1. Continuous welds.
2. Mastic or mastic-plus-embedded fabric systems.
3. Gaskets.

13-610.ABC.3.1.3 High pressure duct systems. High pressure duct systems designed to operate at pressures greater than 3-inch water gauge (4-inch water gauge pressure class), shall be tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual*. The tested duct leakage class, at a test pressure equal to the design duct pressure class rating, shall be equal to or less than Leakage Class 6. Leakage testing may be limited to representative sections of the duct system but in no case shall such tested sections include less than 25 percent of the total installed duct area for the designated pressure class.

13-610.ABC.3.2 Fibrous glass duct, rigid. All rigid fibrous glass ducts and plenums shall be constructed and erected in accordance with the provisions of the NAIMA Fibrous Glass Duct Construction Standards.

All joints, seams and duct wall penetrations including, but not limited to, the joints between sections of duct and between duct and other distribution system components shall be mechanically attached and sealed using approved closure systems as specified in Section 13-610.ABC.3.2.1.

13-610.ABC.3.2.1 Approved closure systems. The following closure systems are approved for rigid fibrous glass ducts when they conform to the approved closure and mechanical attachment requirements of Section 13-610.ABC.3.0:

1. Heat-activated tapes.
2. Pressure-sensitive tapes.
3. Mastics or mastic-plus-embedded fabric systems.

13-610.ABC.3.2.2 Mechanical fastening. Attachments of ductwork to air-handling equipment shall be by mechanical fasteners. Where access is limited, two fasteners on one side shall be acceptable when installed in accordance with Section 13-610.ABC.3.0.6.

13-610.ABC.3.3 Flexible duct systems, nonmetal. Flexible nonmetal ducts shall be joined to all other air distribution system components by either terminal or intermediate fittings. All duct collar fittings shall have a minimum $^5/_8$ inch (16 mm) integral flange for sealing to other components and a minimum 3-inch (76 mm) shaft for insertion into the inner duct core.

Flexible ducts having porous inner cores shall not be used.

Exception: Ducts having a nonporous liner between the porous inner core and the outer jacket. Fastening and sealing requirements shall be applied to such intermediate liners.

All joints of flexible ducts to fittings and fittings to other air distribution system components shall be mechanically attached and sealed as specified in Sections 13-610.ABC.3.3.1 through 13-610.ABC.3.3.6.

13-610.ABC.3.3.1 Duct core to duct fitting, mechanical attachment. The reinforced core shall be mechanically attached to the duct fitting by a drawband installed directly over the wire-reinforced core and the duct fitting. The duct fitting shall extend a minimum of 2 inches (51 mm) into each section of duct core. When the flexible duct is larger than 12 inches (303 mm) in diameter or the design pressure exceeds 1-inch water gauge, the drawband shall be secured by a raised bead or indented groove on the fitting.

13-610.ABC.3.3.2 Duct core to duct fitting, approved closure systems. The reinforced lining shall be sealed to the duct fitting using one of the following sealing materials which conforms to the approved closure and mechanical attachment requirements of Section 13-610.ABC.3.0:

1. Gasketing.
2. Mastic, mastic-plus-embedded fabric, or mastic ribbons.
3. Pressure-sensitive tape.
4. Aerosol sealants, provided that their use is consistent with UL 181.

13-610.ABC.3.3.3 Duct outer jacket to duct collar fitting. The outer jacket of a flexible duct section shall be secured at the juncture of the air distribution system component and intermediate or terminal fitting in such a way as to prevent excess condensation. The outer jacket of a flexible duct section shall not be interposed between the flange of the duct fitting and the flexible duct, rigid fibrous glass duct board, or sheet metal to which it is mated.

13-610.ABC.3.3.4 Duct collar fitting to rigid duct, mechanical attachment. The duct collar fitting shall be mechanically attached to the rigid duct board or sheet metal by appropriate mechanical fasteners, either screws, spin-in flanges, or dovetail flanges.

13-610.ABC.3.3.5 Duct collar fitting to rigid duct, approved closure systems. The duct collar fitting's integral flange shall be sealed to the rigid duct board or sheet metal using one of the following closure systems/materials which conforms to the approved closure and mechanical attachment standards of Section 13-610.ABC.3.0:

1. Gasketing.
2. Mastic or mastic-plus-embedded fabric systems.
3. Mastic ribbons when used to attach a duct collar to sheet metal.
4. Pressure-sensitive tape.

5. Aerosol sealants, provided that their use is consistent with UL 181.

13-610.ABC.3.3.6 Flexible duct installation and support. Flexible ducts shall be configured and supported so as to prevent the use of excess duct material, prevent duct dislocation or damage, and prevent constriction of the duct below the rated duct diameter in accordance with the following requirements:

1. Ducts shall be installed fully extended. The total extended length of duct material shall not exceed 5 percent of the minimum required length for that run.
2. Bends shall maintain a center line radius of not less than one duct diameter.
3. Terminal devices shall be supported independently of the flexible duct.
4. Horizontal duct shall be supported at intervals not greater than 5 feet (1524 mm). Duct sag between supports shall not exceed $^1/_2$ inch (12.7 mm) per foot of length. Supports shall be provided within $1^1/_2$ feet (38 mm) of intermediate fittings and between intermediate fittings and bends. Ceiling joists and rigid duct or equipment may be considered to be supports.
5. Vertical duct shall be stabilized with support straps at intervals not greater than 6 feet (1829 mm).
6. Hangers, saddles and other supports shall meet the duct manufacturer's recommendations and shall be of sufficient width to prevent restriction of the internal duct diameter. In no case shall the material supporting flexible duct that is in direct contact with it be less than $1^1/_2$ inches (38 mm) wide.

13-610.ABC.3.4 Terminal and intermediate fittings. All seams and joints in terminal and intermediate fittings, between fitting subsections and between fittings and other air distribution system components or building components shall be mechanically attached and sealed as specified in Section 13-610.ABC.3.4.1 or 13-610.ABC.3.4.2.

13-610.ABC.3.4.1 Fittings and joints between dissimilar duct types, approved closure systems. Approved closure systems shall be as designated by air distribution system component material type in Section 13-610.ABC.3.

Exception: When the components of a joint are fibrous glass duct board and metal duct, including collar fittings and metal equipment housings, the closure systems approved for fibrous glass duct shall be used.

13-610.ABC.3.4.2 Terminal fittings and air ducts to building envelope components, approved closure systems. Terminal fittings and air ducts which penetrate the building envelope shall be mechanically attached to the structure and sealed to the envelope component penetrated and shall use one of the following closure systems/materials which conform to the approved closure and mechanical application requirements of Section 13-610.ABC.3.0:

1. Mastics or mastic-plus-embedded fabrics.
2. Gaskets used in terminal fitting/grille assemblies which compress the gasket material between the fitting and the wall, ceiling or floor sheathing.

13-610.ABC.3.5 Air-handling units. All air-handling units shall be mechanically attached to other air distribution system components. Air-handling units located outside the conditioned space shall be sealed using approved closure systems conforming to the approved closure and mechanical application requirements of Section 13-610.ABC.3.1.

13-610.ABC.3.5.1 Approved closure systems. Systems conforming to the product and application standards of Section 13-610.ABC.3.0 may be used when sealing air-handling units.

13-610.ABC.3.5.2 Air-handling units. Air-handling units shall be allowed in attics if the following conditions are met:

1. The service panel of the equipment is located within 6 feet (1829 mm) of an attic access.
2. A device is installed to alert the owner or shut the unit down when the condensation drain is not working properly.
3. The attic access opening is of sufficient size to replace the air handler.
4. A notice is posted on the electric service panel indicating to the homeowner that the air handler is located in the attic. Said notice shall be in all capitals, in 16 point type, with the title and first paragraph in bold:

NOTICE TO HOMEOWNER

A PART OF YOUR AIR-CONDITIONING SYSTEM, THE AIR HANDLER, IS LOCATED IN THE ATTIC. FOR PROPER, EFFICIENT, AND ECONOMIC OPERATION OF THE AIR-CONDITIONING SYSTEM, YOU MUST ENSURE THAT REGULAR MAINTENANCE IS PERFORMED.

YOUR AIR-CONDITIONING SYSTEM IS EQUIPPED WITH ONE OR BOTH OF THE FOLLOWING: (1) A DEVICE THAT WILL ALERT YOU WHEN THE CONDENSATION DRAIN IS NOT WORKING PROPERLY OR (2) A DEVICE THAT WILL SHUT THE SYSTEM DOWN WHEN THE CONDENSATION DRAIN IS NOT WORKING. TO LIMIT POTENTIAL DAMAGE TO YOUR HOME, AND TO AVOID DISRUPTION OF SERVICE, IT IS RECOMMENDED THAT YOU ENSURE PROPER WORKING ORDER OF THESE DEVICES BEFORE EACH SEASON OF PEAK OPERATION.

13-610.ABC.3.6 Cavities of the building structure. Cavities in framed spaces, such as dropped soffits and walls, shall not be used to deliver air from or return air to

the conditioning system unless they contain an air duct insert which is insulated in accordance with Section 13-610.ABC.2 and constructed and sealed in accordance with the requirements of Section 13-610.ABC.3 appropriate for the duct materials used.

Exception: Return air plenums.

13-610.ABC.3.6.1 Cavities designed for air transport such as mechanical closets, chases, air shafts, etc. shall be lined with an air barrier and sealed in accordance with Section 13-610.ABC.3.7 and shall be insulated in accordance with Section 13-610.ABC.2.

13-610.ABC.3.6.2 Building cavities which will be used as return air plenums shall be lined with a continuous air barrier made of durable nonporous materials. All penetrations to the air barrier shall be sealed with a suitable long-life mastic material.

Exception: Surfaces between the plenum and conditioned spaces from which the return/mixed air is drawn.

13-610.ABC.3.6.3 Building cavities beneath a roof deck that will be used as return air plenums shall have an insulated roof with the insulation having an *R*-value of at least *R*-19.

13-610.ABC.3.7 Mechanical closets. The interior surfaces of mechanical closets shall be sheathed with a continuous air barrier as specified in Section 13-610.ABC.3.7.1 and shall be sealed with approved closure systems as specified in Section 13-610.ABC.3.7.2. All joints shall be sealed between air barrier segments and between the air barriers of walls and those of the ceiling, floor and door framing. All penetrations of the air barrier including, but not limited to, those by air ducts, plenums, pipes, service lines, refrigerant lines, electrical wiring, and condensate drain lines shall be sealed to the air barrier with approved closure systems.

Exception: Air passageways into the closet from conditioned space that are specifically designed for return air flow.

Through-wall, through-floor and through-ceiling air passageways into the closet shall be framed and sealed to form an air-tight passageway using approved air duct materials and approved closure systems.

Duct penetrations through any part of the ceiling, walls or floor of a mechanical closet shall have sufficient space between surrounding ceiling, walls or floor and any duct or plenum penetration to allow for sealing of the penetration and inspection of the seal.

Clothes washers, clothes dryers, combustion water heaters and atmospheric combustion furnaces shall not be located in mechanical closets used as return air plenums.

13-610.ABC.3.7.1 Approved air barriers. The following air barriers are approved for use in mechanical closets:

1. One-half-inch-thick (12.7 mm) or greater gypsum wallboard, taped and sealed.
2. Other panelized materials having inward facing surfaces with an air porosity no greater than that of a duct product meeting Section 22 of UL 181 which are sealed on all interior surfaces to create a continuous air barrier.

13-610.ABC.3.7.2 Approved closure systems. The following closure systems are approved for use in mechanical closets:

1. Gypsum wallboard joint compound over taped joints between gypsum wallboard panels.
2. Sealants complying with the product and application standards of Section 13-610.ABC.3.2.1 for fibrous glass ductboard.
3. A suitable long-life caulk or mastic compliant with the locally adopted mechanical code for all applications.

13-610.ABC.3.8 Enclosed support platforms. Enclosed support platforms located between the return air inlet(s) from conditioned space and the inlet of the air-handling unit or furnace, shall contain a duct section constructed entirely of rigid metal, rigid fibrous glass duct board, or flexible duct which is constructed and sealed according to the respective requirements of Section 13-610.ABC.3. and insulated according to the requirements of Section 13-610.ABC.2.

The duct section shall be designed and constructed so that no portion of the building structure, including adjoining walls, floors and ceilings, shall be in contact with the return air stream or function as a component of this duct section.

The duct section shall not be penetrated by a refrigerant line chase, refrigerant line, wiring, pipe or any object other than a component of the air distribution system.

Through-wall, through-floor and through-ceiling penetrations into the duct section shall contain a branch duct which is fabricated of rigid fibrous glass duct board or rigid metal and which extends to and is sealed to both the duct section and the grille side wall surface. The branch duct shall be fabricated and attached to the duct insert in accordance with Section 13-610.ABC.3.2 or Section 13-610.ABC.3.1, respective to the duct type used.

13-610.A Requirements specific to Method A.

13-610.A.1 Duct types. Duct systems shall include both supply and return air sections and shall be described in sufficient detail to allow the building official to determine code compliance. The impact of air distribution system efficiency in the energy performance calculation shall be determined from the EnergyGauge USA Fla/Res computer program in accordance with Section 13-613 of this code.

13-610.A.2 Installation criteria for homes claiming the tested duct option. The tested duct option may be claimed in the EnergyGauge USA Fla/Res computer program where the air distribution system is tested in accordance with ASHRAE 152, in which case measured duct air leakage val-

in the EnergyGauge USA Fla/Res computer program where the air distribution system is tested in accordance with ASHRAE 152, in which case measured duct air leakage values shall be used. Tested duct leakage shall be determined and documented by a Certified Class 1 Florida Rater.

13-610.A.3 Installation criteria for homes claiming the factory-sealed air-handling unit option. The factory-sealed air-handling unit option may be claimed in the EnergyGauge USA Fla/Res computer program if the unit has been tested and certified by the manufacturer to have achieved a 2 percent or less leakage rate at 1-inch water gauge when all air inlets, air outlets and condensate drain port(s), when present, are sealed at an air pressure of 1-inch water gauge with no greater than 20percent design cubic foot per minute discharge.

13-610.B Requirements specific to Method B.

13-610.B.1 Ducts installed. All ducts shall be insulated to at least the level required by Table 11B-1 on Form 1100B.

13-610.C Requirements specific to Method C.

13-610.C.1 Additions. New ducts that are installed to serve an addition shall either be insulated to *R*-6 or be installed in conditioned space as designated on Table 11C-1 of Form 1100C.

Exception: Only new or replacement ducts installed as part of the addition shall meet this requirement.

13-610.C.2 Renovations. Replacement duct systems that are not in conditioned space shall be insulated to levels specified in Section 13-610.C.1.

Exception: Only new or replacement ducts installed as part of the renovation shall meet this requirement.

13-610.C.3 Manufactured homes and manufactured buildings. Site-installed components and features of the air distribution system(s) of manufactured homes shall be insulated, constructed, sealed and supported in accordance with the requirements of Sections 13-610.ABC.2 and 13-610.ABC.3. The duct connection between the air distribution systems of separate units of multiple unit manufactured homes and buildings shall be installed, sealed and inspected according to the provisions of this code.

Manufactured homes and buildings having interior furnaces and site-installed single package air conditioners which share the same supply registers shall have an automatic backflow damper installed between the air conditioning unit and the factory-installed duct to prevent the functioning of return grilles as supply registers and to prevent the forced passage of conditioned air through inactive air handlers when another system is in operation.

13-610.C.4 Building systems. Newly manufactured air distribution system components installed in existing buildings shall meet the minimum requirements for air distribution systems contained in Sections 13-610.ABC.2 through 13-610.ABC.8, as appropriate. See Section 13-101.6 for exceptions.

SECTION 13-611
PIPING

13-611.ABC Mandatory requirements for Methods A, B and C.

13-611.ABC.1 Piping insulation. All piping installed to service buildings and within buildings, including the vapor line of HVAC refrigerant piping, shall be thermally insulated in accordance with Table 13-611.ABC.1, except as stated herein (for service water heating systems, see Section 13-612.ABC.5).

Exceptions: Piping insulation is not required in the following cases:

1. Piping installed within HVAC equipment.
2. Piping containing fluid at temperatures between 55°F and 120°F (13°C to 49°C).
3. Piping within the conditioned space.
4. Piping within basements or unvented crawl spaces (plenums) having insulated walls.

13-611.ABC.1.1 Other insulation thicknesses. Insulation thickness in Table 13-611.ABC.1 are based on insulation having thermal resistance in the range of 4.0 to 4.6°F·ft²·h/Btu· per inch of thickness on a flat surface at a mean temperature of 75°F (24°C).

Minimum insulation thickness shall be increased for

TABLE 13-611.ABC.1
MINIMUM PIPE INSULATION

Piping System Types	Fluid Temperature Range°F	Runouts[2] (inches)	Insulation for Pipe < 1"	Thickness Sizes[1] 1.25 - 2"
HEATING SYSTEMS				
Steam and hot water				
Low pressure/temp.	201 - 250	1.0	1.5	1.5
Low temperature	120 - 200	0.5	1.0	1.0
Steam condensate (for feed water)	Any	1.0	1.0	1.5
COOLING SYSTEMS	40 - 55	0.5	0.5	0.75
Chilled water, refrigerant or brine	Below 40	1.0	1.0	1.50

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8

1. For piping larger than 1 inch diameter and exposed to outdoor ambient temperatures, increase thickness by 0.5 inch.
2. Runouts to individual thermal units (not exceeding 12 feet in length).
3. The required minimum thicknesses do not consider water vapor transmission and condensation. Additional insulation, vapor retarders, or both, may be required to limit water vapor transmission and condensation.

1. For materials with thermal resistivity greater than *R*-4.6, the minimum insulation thickness may be reduced as follows:

   New minimum thickness =

   $$\frac{4.6 \times \text{Table } 13-611.\text{ABC.1 Thickness}}{\text{Actual Resistivity}}$$

2. For material with thermal resistivity less than R-4.0, the minimum insulation thickness shall be increased as follows:

   New minimum thickness =

   $$\frac{4.0 \times \text{Table } 13-611.\text{ABC.1 Thickness}}{\text{Actual Resistivity}}$$

SECTION 13-612
WATER HEATING SYSTEMS

13-612.ABC Mandatory requirements for Methods A, B and C.

13-612.ABC.1 Sizing. Reserved.

13-612.ABC.2 Controls.

13-612.ABC.2.1 Storage water heater temperature controls.

13-612.ABC.2.1.1 Automatic controls. Service water heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable temperature settings for the intended use. The minimum temperature setting range shall be from 100°F to 140°F (38°C to 60°C).

13-612.ABC.2.1.2 Shut down. A separate switch or a clearly marked circuit breaker shall be provided to permit the power supplied to electric service systems to be turned off. a separate valve shall be provided to permit the energy supplied to the main burner(s) of combustion types of service water heating systems to be turned off.

13-612.ABC.2.2 Heat traps. Storage water heaters not equipped with integral heat traps and having vertical pipe risers shall have heat traps installed on both the inlets and outlets. External heat traps shall consist of either a commercially available heat trap or a downward and upward bend of at least 3 $^1/_2$ inches (89 mm) in the hot water distribution line and cold water line located as close as possible to the storage tank.

13-612.ABC.2.3 Swimming pool and spa temperature controls.

13-612.ABC.2.3.1 On-off switch required. All pool and spa heaters shall be equipped with an on-off switch mounted for easy access to allow the heater to be shut off without adjusting the thermostat setting and to allow restarting without relighting the pilot light.

13-612.ABC.2.3.2 Covers required. Spas and heated swimming pools shall be equipped with a cover designed to minimize heat loss.

Exception: Outdoor pools deriving over 70 percent of the energy for heating from nondepletable on site-recovered sources computed over an operating season are exempt from this requirement.

13-612.ABC.2.3.3 Time clocks on private pools. Time clocks shall be installed on private pools so that the pump can be set to run during off-peak electric demand periods and can be set for the minimum time necessary to maintain the water in a clear and sanitary condition in keeping with applicable health standards.

Exceptions: Pumps connected to swimming pool solar water heating systems or any pool legally considered a public pool.

13-612.ABC.2.3.4 Pool heater efficiency. All gas- and oil-fired pool heaters when tested in accordance with ANSI Z 21.56 shall have a minimum thermal efficiency of 78 percent.

Heat pump pool heaters shall be tested in accordance with ARI 1160, Table 2. Standard Rating Conditions-Low Air Temperature, and shall have a minimum COP of 4.0.

13-612.ABC.2.4 Showers. Showers used for other than safety reasons shall be equipped with flow control devices to limit the water discharge to a maximum of 2.50 gpm (.16 L/S) per shower head at a distribution pressure of 80 psig (552 kPa) when tested in accordance with the procedures of ANSI A112.18.1M. Flow-restricting inserts used as a component part of a showerhead shall be mechanically retained at the point of manufacture.

13-612.ABC.3 Equipment performance standards.

13-612.ABC.3.1 Electric water heater efficiencies.

13-612.ABC.3.1.1 Storage capacities of 120 gallons or less. All automatic electric storage water heaters having a storage capacity of 120 gallons (454 L) or less and an input rating of 12 kw or less shall, when tested in accordance with the DOE Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B, 10 CFR Part 430, meet the performance minimums listed in Table 13-612.ABC.3.

13-612.ABC.3.1.2 Storage capacities greater than 120 gallons. Performance minimums for electric storage water heaters with capacities greater than 120 gallons (454 L) or an input rate greater than 12 kw shall have a standby loss of .30+27/V_T percent/hour or less, where V_T is the tested storage volume in gallons and tested in accordance with ANSI test method Z21.10.3.

13-612.ABC.3.2 Gas- and oil-fired water heater efficiencies.

TABLE 13-612.ABC.3
MINIMUM PERFORMANCE STANDARDS
WATER HEATING EQUIPMENT: FIRED STORAGE WATER HEATER MINIMUM ENERGY FACTORS (EF)

TYPE / VOLUME	TANK VOLUME (GALLONS)								
	20	30	40	50	65	75	80	100	120
ELECTRIC: Up to 120 gallon or 12kW input	.94	.93	.92	.90	.88	—	.86	.84	.81
GAS: Up to 100 gallon or 75,000 Btu/h input	.63	.61	.59	.58	.55	.53	—	.48	—
OIL: Up to 50 gallon or 75,000 Btu/h input	—	.53	.51	.50	—	—	—	—	—

13-612.ABC.3.2.1 Tanks with input ratings of 75,000 Btu/h or less (Gas) or 105,000 Btu/h or less (oil). All gas- and oil-fired automatic storage water heaters with capacities of 100 gallons or less and an input rating of 75,000 Btu/h or less (gas) or 105,000 Btu/h or less (oil) shall, when tested in accordance with the DOE Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B, 10 CFR Part 430, meet the performance minimums listed in Table 13-612.ABC.3.

13-612.ABC.3.2.2 Tanks with input ratings greater than 75,000 Btu/h (gas) or greater than 105,000 Btu/h (oil). All gas-fired storage water heaters with input ratings greater than 75,000 Btu/h but less than or equal to 155,000 Btu/h, and all oil-fired storage water heaters with input ratings greater than 105,000 Btu/h but less than or equal to 155,000 Btu/h, shall have a steady-state combustion efficiency E_t of .78 or less and a standby loss of $1.30+114/V_T$ (in percent/hour) or less, where V_T is the tested storage volume in gallons. All gas- and oil-fired storage water heaters with input ratings greater than 155,000 Btu/h shall have a steady-state combustion efficiency E_t of .78 or more and a standby loss of $1.30+95/V_T$, where V_T is the tested storage volume in gallons.

13-612.ABC.3.2.3 Gas instantaneous or tankless water heaters. All gas-fired instantaneous (tankless) water heaters that a) initiate heating based on sensing water flow; b) are designed to deliver water at a controlled temperature of less than 180 °F (82 °C); c) have an input less than 200,000 Btu/h (210 MJ/h); d) have a manufacturer's specified storage capacity of less than 2 gallons (7.6 L), and, e) have either a fixed or variable burner input shall, when tested in accordance with the DOE Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B, Title 10 CFR 430, meet the performance minimums established in Title 10 CFR 430.32, Energy and Water Conservation Standards and Effective Dates.

13-612.ABC.3.3 Unfired storage tanks. All unfired storage tanks shall have a standby loss of 6.5 Btu/h/ft^2 or less, based on an 80°F (27°C) water-air temperature difference.

13-612.ABC.3.4 Solar water heating systems. Solar systems for domestic hot water production are rated by the annual solar energy factor of the system. The solar energy factor of a system shall be determined from the Florida Solar Energy Center *Directory of Certified Solar Systems*. Solar collectors shall be tested in accordance with ISO Standard 9806, *Test Methods for Solar Collectors*, and SRCC Standard TM-1, *Solar Domestic Hot Water System and Component Test Protocol*. Collectors in installed solar water heating systems should meet the following criteria:

1. Be installed with a tilt angle between 10 degrees and 40 degrees of the horizontal; and
2. Be installed at an orientation within 45 degrees of true south.

13-612.ABC.3.5 Combination service water heating and space heating equipment. Service water heating equipment used to provide additional functions (e.g. space heating) as part of a combination (integrated) system shall comply with minimum performance requirements for water heating equipment. For combined gas storage tank water heating and space heating systems tested to ANSI/ASHRAE 124, the EF used shall be the effective water heating efficiency (CA_{ef}) listed for the appliance by the Gas Appliance Manufacturer's Association (GAMA). For combined gas instantaneous (tankless) water heating and space heating systems, the EF used shall be determined in accordance with the DOE Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B, Title 10 CFR 430.

Combination systems utilizing a storage tank water heater as the heat source for space heating purposes with input ratings of 105,000 Btu/h (360 m^3/kW) or less shall utilize a water heater listed by the Gas Appliance Manufacturer's Association (GAMA). Changeouts of burners or heating elements to increase capacity shall not be made unless the unit has been listed at that capacity by GAMA.

Combination systems utilizing a storage tank water heater as the heat source for space heating purposes with input ratings greater than 105,000 Btu/h (360 m^3/kW) shall comply with the criteria of Section 13-412.ABC.3.4, Subchapter13-4.

13-612.ABC.4 Pumps. Circulating hot water systems shall be arranged so that the circulating pump(s) can be conveniently turned off (automatically or manually) when the hot water system is not in operation.

13-612.ABC.5 Piping insulation. Circulating hot water systems (including piping for waste heat recovery systems (HRUs)) shall be insulated with insulation of at least $^1/_2$ inch (12.7 mm) minimum thickness with a thermal conductivity no greater than 0.28 Btu/in./h·ft²°F.

Pipe insulation buried underground shall be as specified by the manufacturer for underground use.

13-612.A Requirements specific to Method A.

13-612.A.1 Water heating system energy loads. Energy loads for service water heating systems shall be based on the appropriate efficiency rating for the system to be installed from the EnergyGauge USA Fla/Res computer program.

13-612.A.2 Additions. Water heating shall be considered in Method A calculations if any of the following conditions are met:

1. Existing systems are replaced during construction;
2. Additional water heaters are installed; or
3. A gas, solar, HRU or dedicated heat pump is installed to gain calculation credits.

13-612.B Requirements specific to Method B. Water heating systems are categorized as electric resistance, gas and oil and other. Water heating equipment shall meet the applicable minimum efficiencies listed on Table 11B-1 of Form 1100B.

13-612.C Requirements specific to Method C. New water heating equipment installed in small additions and renovations shall meet the minimum efficiencies given on Table 11C-1 of Form 1100C.

13-612.C.1 Additions. All new water heaters installed in an addition shall meet the minimum efficiencies listed in Section 13-612.ABC.3, Table 13-612.ABC.3.

Exception: Only water heating systems which are being replaced or installed as part of the addition shall meet this requirement.

13-612.C.2 Renovations. Minimum efficiencies for water heating equipment installed in renovations shall be not less than those listed in Table 13-612.ABC.3 and Section 13-612.ABC.3.

Exception: Only water heating systems which are being replaced or installed as part of the renovation shall meet this requirement.

13-612.C.3 Building systems. New water heating systems installed in existing buildings shall meet the minimum requirements for that system in Section 13-612.ABC.

SECTION 13-613
CALCULATIONAL PARAMETERS SPECIFIC TO COMPLIANCE METHOD A

13-613.A Method A compliance simulation and end-use load determination. Except as specified by this section, the baseline home and as-built home shall be configured and analyzed using identical methods and techniques.

13-613.A.1 Home Specification. The baseline home and as-built home shall be configured and analyzed as specified by Table 13-613.A.1-1.

TABLE 13-613.A.1-1
SPECIFICATIONS FOR BASELINE AND AS-BUILT HOMES

Building Component	Baseline Home	As-Built Home
Above-grade walls:	Type: wood frame Gross area: same as As-Built home	Same as As-Built home Same as As-Built home
	U-Factor: 0.082	Same as As-Built home
	Solar absorptance = 0.75	Same as As-Built home
	Emittance = 0.90	Same as As-Built home
Conditioned basement walls:	Type: same as As-Built home	Same as As-Built home
	Gross area: same as As-Built home	Same as As-Built home
	U-Factor: 0.36 with the insulation layer on the interior side of walls	Same as As-Built home
Floors over unconditioned spaces:	Type: wood frame	Same as As-Built home
	Gross area: same as As-Built home	Same as As-Built home
	U-Factor: 0.064	Same as As-Built home
Ceilings:	Type: wood frame	Same as As-Built home
	Gross area: same as As-Built home	Same as As-Built home
	U-Factor: 0.035	Same as As-Built home
Roofs:	Type: composition shingle on wood sheathing	Same as As-Built home
	Gross area: same as As-Built home	Same as As-Built home
	Solar absorptance = 0.75	
	Emittance = 0.90	Same as As-Built home Same as As-Built home
Attics:	Type: vented with aperture = 1 ft² per 300 ft² ceiling area	Same as As-Built home
Foundations:	Type: same as As-Built home	Same as As-Built home
	Gross Area: same as As-Built home	Same as As-Built home
	R-value: 0	Same as As-Built home
Crawl spaces:	Type: vented with net free vent aperture = 1 ft² per 150 ft² of crawl space floor area.	Same as As-Built home, but not less net free ventilation area than the baseline home unless an approved ground cover in accordance with Section 408.1 of the *Florida Building Code, Residential,* is used, in which case, the same net free ventilation area as the As-Built home down to a minimum net free vent area of 1 ft² per 1,500 ft² of crawl space floor area.
Doors:	Area: 40 ft² Orientation: North	Same as As-Built home Same as As-Built home
	U-factor: 0.75	Same as As-Built home

(continued)

TABLE 13-613.A.1-1 - continued
SPECIFICATIONS FOR BASELINE AND AS-BUILT HOMES

Glazing:[a]	Total area[b] = 18% of conditioned floor area	Same as As-Built home
	Orientation: equally distributed to four (4) cardinal compass orientations (N,E,S,&W)	Same as As-Built home
	U-factor: 0.75	Same as As-Built home
	SHGC: 0.40 Interior shade	Same as As-Built home
	coefficient: Summer = 0.70	Same as As-Built home [c]
	Winter = 0.85	Same as As-Built home
	External shading: none	Same as As-Built home
Skylights:	None	Same as As-Built home
Thermally isolated sunrooms:	None	Same as As-Built home
Air exchange rate:	Specific Leakage Area (SLA)[d] = 0.00036 (assuming no energy recovery)	For residences that are not tested, the same as the Baseline home for residences with mechanical ventilation systems and with envelope leakage tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate (e) combined with the As-Built mechanical ventilation rate (f) where such mechanical ventilation rate shall not be less than 0.01 x CFA + 7.5 x (N_{br}+1)
Mechanical ventilation:	None, except where a mechanical ventilation system is specified by the As-Built home, in which case:	Same as As-Built home
	Annual vent fan energy use: kWh/yr = 0.03942*CFA + 29.565*(N_{br}+1)(per dwelling unit) where: CFA = conditioned floor area N_{br} = number of bedrooms	Same as As-Built home
Internal gains:	IGain = 17,900 + 23.8*CFA + 4104*N_{br} (Btu/day per dwelling unit)	Same as Baseline Home
Internal mass:	An internal mass for furniture and contents of 8 pounds per square foot of floor area	Same as Baseline home, plus any additional mass specifically designed as a thermal storage element[g] but not integral to the building envelope or structure

(continued)

TABLE 13-613.A.1-1 - continued
SPECIFICATIONS FOR BASELINE AND AS-BUILT HOMES

Structural mass:	For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air	Same as As-Built home
	For masonry basement walls, same as as-built home, but with insulation located on the interior side of the walls	Same as As-Built home
	For other walls, for ceilings, floors, and interior walls, wood frame construction	Same as As-Built home
Heating systems:[h],[i]	Fuel type: same as As-Built home	Same as As-Built home[i]
	Efficiencies:	
	Electric: air source heat pump with prevailing federal minimum efficiency	Same as As-Built home
	Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency	Same as As-Built home
	Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency	Same as As-Built home
	Capacity: sized in accordance with Section 13-607.ABC.1 of this code.	Same as As-Built home
Cooling systems:[h],[k]	Fuel type: Electric	Same as As-Built home[k]
	Efficiency: in accordance with prevailing federal minimum standards	
	Capacity: sized in accordance with Section 13-607.ABC.1 of this code.	
Service water heating systems:[h],[m]	Fuel type: same as As-Built home	Same as As-Built home[m]
	Efficiency: in accordance with prevailing federal minimum standards	Same as As-Built home
	Use (gal/day): 30*N_{du}+10*N_{br} where N_{du} = number of dwelling units	Same as Baseline home
	Tank temperature: 120°F	Same as Baseline home
Thermal distribution systems:	A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies.	Using As-Built duct locations and a DSE of 0.88, except when tested in accordance with ASHRAE 152(n), in which case measured duct air leakage values shall be used

(continued)

TABLE 13-613.A.1-1 - continued
SPECIFICATIONS FOR BASELINE AND AS-BUILT HOMES

Thermostat:	Type: manual Temperature setpoints: cooling temperature set point = 78°F; heating temperature set point = 68°F	Type: Same as As-Built home Temperature setpoints: same as the Baseline home, except when programmable thermostats are used in accordance with Sections 13-607.A.2.6 and 13-608.A.2.6 of this code

NOTES:

(a) Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements. For doors where the sunlight-transmitting opening is less than one-third of the door area, the glazing area of the sunlight transmitting opening shall be used. For all other doors, the glazing area shall be the rough frame opening area for the door including the door and the frame.

(b) For homes with conditioned basements and for multi-family attached homes the following formula shall be used to determine total window area:

$A_F = 0.18 \times A_{FL} \times F_A$

where:

A_F = Total fenestration area.

A_{FL} = Total floor area of directly conditioned space.

F_A = (Above-grade thermal boundary gross wall area)/(above-grade boundary gross wall area + 0.5 x below-grade boundary gross wall area)

F = (Above-grade thermal boundary gross wall area)/(above-grade thermal boundary gross wall area + common gross wall area) or 0.75, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions *Abovegrade thermal boundary wall* is any portion of a thermal boundary wall not in contact with soil *Below-grade boundary wall* is any portion of a thermal boundary wall in soil contact

Common wall is the total wall area of walls adjacent to another conditioned living unit, not including common foundation and attic walls.

(c) For fenestrations facing within 15 degrees of due south that are directly coupled to thermal storage mass, the winter interior shade coefficient shall be permitted to increase to 0.95 in the As-Built home.

(d) Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:

SLA = L/CFA (where L and CFA are in the same units).

Hourly calculations using the procedures given in the *ASHRAE Handbook of Fundamentals*, Chapter 27, page 27.21, Equation 40 (Sherman-Grimsrud model) using Shelter Class 4 shall be used to determine the air exchange rate resulting from infiltration.

(e) Tested envelope leakage shall be determined in accordance with Section 5.1 of ASHRAE 119 and documented by a Certified Class 1 Florida Rater. Either hourly calculations using the procedures given in the *ASHRAE Handbook of Fundamentals*, Chapter 27, page 27.21, Equation 40 (Sherman-Grimsrud model) using Shelter Class 4 shall be used to determine the air exchange rates resulting from infiltration.

(f) The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of *ASHRAE Handbook of Fundamentals*, page 27.23.

(g) Thermal storage element shall mean a component not normally part of the floors, walls, or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees of due south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.

(h) For an as-built home with multiple heating, cooling, or water heating systems using different fuel types, the applicable system capacities and fuel types shall be weighted in accordance with the loads distribution (as calculated by accepted engineering practice for that equipment and fuel type) of the subject multiple systems. For the Baseline home, the prevailing federal minimum efficiency shall be assumed except that the efficiencies given in Table 13-613.A.1-1(a) below will be assumed when:

1) A type of device not covered by NAECA is found in the As-Built home;
2) The As-Built home is heated by electtricity using a device other than an air source heat pump; or
3) The As-Built home does not contain one or more of the required HVAC equipment systems.

TABLE 13-613.A.1-1(a)
DEFAULT BASELINE HOME HEATING AND COOLING EQUIPMENT EFFICIENCIES (i) (k) (m) (n)

As-Built Home Fuel	Function	Baseline Home Device
Electric	Heating	7.7 HSPF air source heat pump
Nonelectric warm air furnace or space heater	Heating	78% AFUE gas furnace
Nonelectric boiler	Heating	80% AFUE gas boiler
Any type	Cooling	13 SEER electric air conditioner

(i) For an As-Built home without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the baseline home and As-Built home. For electric heating systems, the prevailing federal minimum efficiency air-source heat pump shall be selected.

(k) For an As-Built home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the Baseline home and the As-Built home.

(m) For an as-built home with a nonstorage type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency with the same fuel as the predominant heating fuel type shall be assumed for both the Rated and Baseline Homes.

(n) Tested duct leakage shall be determined and documented by a Certified Class 1 Florida Rater.

13-613.A.2 Calculation of end-use energy loads for code compliance determination.

13-613.A.2.1 The energy loads for heating, cooling and hot water in the As-Built home shall be normalized to account for the differences in improvement potential that exist across equipment types using the following formula in accordance with the paper "The HERS Rating Method and the Derivation of the Normalized Modified Loads Method," Research Report No. FSEC-RR-54-00, Florida Solar Energy Center.

nMEUL = REUL * (nEC_x /EC_r)

where:

nMEUL = Normalized modified end-use loads (for heating, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

REUL = Baseline home end-use loads (for heating, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

EC_r = Estimated energy consumption for Baseline home's end uses (for heating, including auxiliary electric consumption, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

and where:

nEC_x = (a* EEC_x – b)*(EC_x * EC_r * DSE_r) / (EEC_x * REUL)

where:

nEC_x = Normalized energy consumption for As-Built home's end uses (for heating, including auxiliary electric consumption, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

EC_r = Estimated energy consumption for Baseline home's end uses (for heating, including auxiliary electric consumption, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

EC_x = Estimated energy consumption for the As-Built home's end uses (for heating, including auxiliary electric consumption, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

EEC_x = Equipment efficiency coefficient for the As-Built home's equipment, such that EEC_x equals the energy consumption per unit load in like units as the load, and as derived from the Manufacturer's Equipment Performance Rating (MEPR) such that EEC_x equals 1.0 / MEPR for AFUE, COP or EF ratings, or such that EEC_x equals 3.413 / MEPR for HSPF, EER or SEER ratings.

DSE_r = REUL/EC_r * EEC_r For simplified system performance methods, DSE_r equals 0.80 for heating and cooling systems. However, for detailed modeling of heating and cooling systems, DSE_r may be less than 0.80 as a result of part load performance degradation, coil air flow degradation, improper system charge and auxiliary resistance heating for heat pumps. Except as otherwise provided by these standards, where detailed systems modeling is employed, it must be applied equally to both the Baseline and the As-Built homes.

EEC_r = Equipment efficiency coefficient for the Baseline home's equipment, such that EEC_r equals the energy consumption per unit load in like units as the load, and as derived from the manufacturer's equipment performance rating (MEPR) such that EEC_r equals 1.0 / MEPR for AFUE, COP or EF ratings, or such that EEC_r equals 3.413 / MEPR for HSPF, EER or SEER ratings.

REUL = Baseline home end use loads (for heating or cooling) as computed using EnergyGauge USA Fla/Res.

and where the coefficients *a* and *b* are as defined by Table 13-613.A.2-1 below:

TABLE 13-613.A.2-1
COEFFICIENTS *a* and *b*

Fuel Type and End Use	a	b
Electric space heating	2.2561	0
Fossil fuel* space heating	1.0943	0.4043
Biomass space heating	0.8850	0.4047
Electric air conditioning	3.8090	0
Electric water heating	0.9200	0
Fossil fuel* water heating	1.1877	1.0130

*Such as natural gas, LP, fuel oil

13-613.A.2.2 Following normalization of the heating, cooling and hot water energy consumptions for the As-Built home as specified in Section 13-613.A.2.1 above, the Baseline home's total reference end-use loads for heating, cooling and hot water (REULtot) shall be compared with the proposed As-Built home's total normalized modified end use loads for heating, cooling and hot water (nMEULtot). If the total normalized modified loads of the proposed As-Built home (nMEULtot) are equal to or less than the total reference loads of the Baseline home (REULtot), the proposed As-Built home complies with this code.

APPENDIX 13-A
JURISDICTIONAL DATA

PERMITTING OFFICE	JURISDICTION NUMBER	CLIMATE ZONE	REPORTING GROUP
ALACHUA COUNTY	111000	3	III
ALACHUA	111400	3	III
ALACHUA DISTRICT SCHOOLS	111100	3	III
UNIVERSITY OF FLORIDA	111200	3	III
GAINESVILLE	111300	3	III
HIGH SPRINGS	111500	3	III
NEWBERRY	111800	3	III
WALDO	111900	3	III
SANTA FE COMMUNITY COLLEGE	112000	3	III
BAKER COUNTY	121000	3	III
MACCLENNY	121100	3	III
BAKER DISTRICT SCHOOSL	121200	3	III
BAY COUNTY	131000	1	III
CALLAWAY	131100	1	III
LYNN HAVEN	131300	1	III
MEXICO BEACH	131400	1	III
PANAMA CITY	131500	1	III
PANAMA CITY BEACH	131600	1	III
BAY DISTRICT SCHOOLS	131700	1	III
SPRINGFIELD	131800	1	III
GULF COAST COMMUNITY COLLEGE	131900	1	III
BRADFORD COUNTY	141000	3	III
BRADFORD DISTRICT SCHOOLS	141100	3	III
BREVARD COUNTY	151000	6	II
CAPE CANAVERAL	151100	6	II
COCOA	151200	6	II
COCOA BEACH	151300	6	II
INDIATLANTIC	151400	6	II
INDIAN HARBOR BEACH	151500	6	II
MALABAR	151600	6	II
MELBOURNE	151700	6	II
MELBOURNE BEACH	151800	6	II
MELBOURNE VILLAGE	151900	6	II
PALM BAY	152000	6	II
PALM SHORES	152100	6	II
ROCKLEDGE	152200	6	II
SATELLITE BEACH	152300	6	II
TITUSVILLE	152400	6	II

WEST MELBOURNE	152500	6	II
BREVARD DISTRICT SCHOOLS	152600	6	II
BREVARD COMMUNITY COLLEGE	152700	6	II
BROWARD COUNTY	161000	8	II
COCONUT CREEK	161100	8	II
COOPER CITY	161200	8	II
CORAL SPRINGS	161300	8	II
DANIA	161400	8	II
DAVIE	161500	8	II
DEERFIELD BEACH	161600	8	II
FORT LAUDERDALE	161700	8	II
HALLANDALE	161900	8	II
HOLLYWOOD	162100	8	II
LAUDERDALE BY THE SEA	162200	8	II
LAUDERDALE LAKES	162300	8	II
LAUDERHILL	162400	8	II
LIGHTHOUSE POINT	162600	8	II
MARGATE	162700	8	II
MIRAMAR	162800	8	II
NORTH LAUDERDALE	162900	8	II
OAKLAND PARK	163000	8	II
PARKLAND	163100	8	II
PEMBROKE PARK	163200	8	II
PEMBROKE PINES	163300	8	II
PLANTATION	163400	8	II
POMPANO BEACH	163500	8	II
SEA RANCH LAKES	163600	8	II
SUNRISE	163700	8	II
TAMARAC	163800	8	II
WESTON	163850	8	II
WILTON MANORS	163900	8	II
BROWARD DISTRICT SCHOOLS	164000	8	II
BROWARD COMMUNITY COLLEGE	164100	8	II
CALHOUN COUNTY	171000	1	III
CALHOUN DISTRICT SCHOOLS	171100	1	III
BLOUNTSTOWN	171200	1	III
CHARLOTTE COUNTY	181000	7	III
PUNTA GORDA	181100	7	III
CHARLOTTE DISTRICT SCHOOLS	181200	7	III
CITRUS COUNTY	191000	4	III
CRYSTAL RIVER	191100	4	III
INVERNESS	191200	4	III
CITRUS DISTRICT SCHOOLS	91300	4	III
CLAY COUNTY	201000	3	III

GREEN COVE SPRINGS	201100	3	III
ORANGE PARK	201300	3	III
PENNEY FARMS	201400	3	III
CLAY DISTRICT SCHOOLS	201500	3	III
COLLIER COUNTY	211000	7	III
EVERGLADES CITY	211100	7	III
MARCO ISLAND	211300	7	III
NAPLES	211200	7	III
COLLIER DISTRICT SCHOOLS	211400	7	III
COLUMBIA COUNTY	221000	3	III
LAKE CITY	221200	3	III
COLUMBIA DISTRICT SCHOOLS	221300	3	III
LAKE CITY COMMUNITY COLLEGE	221400	3	III
DESOTO COUNTY	241000	5	III
DESOTO DISTRICT SCHOOLS	241100	5	III
DIXIE COUNTY	251000	2	III
DIXIE DISTRICT SCHOOLS	251100	2	III
DUVAL COUNTY	261000	3	III
ATLANTIC BEACH	261100	3	III
BALDWIN	261200	3	III
JACKSONVILLE	261300	3	III
JACKSONVILLE BEAC	261400	3	III
NEPTUNE BEACH	261500	3	III
DUVAL DISTRICT SCHOOLS	261600	3	III
FLORIDA COMMUNITY COLLEGE	261700	3	III
UNIVERSITY OF NORTH FLORIDA	261800	3	III
ESCAMBIA COUNTY	271000	1	III
PENSACOLA	271100	1	III
ESCAMBIA DISTRICT SCHOOLS	271200	1	III
PENSACOLA COMMUNITY COLLEGE	271300	1	III
UNIVERSITY OF WEST FLORIDA	271400	1	III
FLAGLER COUNTY	281000	3	III
BEVERLY BEACH	281100	3	III
BUNNELL	281200	3	III
FLAGLER BEACH	281300	3	III
FLAGLER DISTRICT SCHOOLS	281400	3	III
PALM COAST	281500	3	III
FRANKLIN COUNTY	291000	2	III
CARRABELLE	291200	2	III
FRANKLIN DISTRICT SCHOOLS	291300	2	III
GADSDEN COUNTY	301000	2	III
CHATTAHOOCHEE	301100	2	III
GRETNA	301300	2	III
HAVANA	301400	2	III

QUINCY	301500	2	III
GADSDEN DISTRICT SCHOOLS	301600	2	III
GILCHRIST COUNTY	311000	2	III
GILCHRIST DISTRICT SCHOOLS	311100	2	III
TRENTON	311300	2	III
GLADES COUNTY	321000	7	III
MOORE HAVEN	321100	7	III
GLADES DISTRICT SCHOOLS	321200	7	III
GULF COUNTY	331000	1	III
PORT ST. JOE	331100	1	III
GULF DISTRICT SCHOOLS	331200	1	III
HAMILTON COUNTY	341000	2	III
HAMILTON DISTRICT SCHOOLS	341100	2	III
HARDEE COUNTY	351000	5	III
BOWLING GREEN	351100	5	III
ZOLFO SPRINGS	351300	5	III
HARDEE DISTRICT SCHOOLS	351400	5	III
HENDRY COUNTY	361000	7	III
CLEWISTON	361100	7	III
HENDRY DISTRICT SCHOOLS	361200	7	III
HERNANDO COUNTY	371000	4	III
BROOKSVILLE	371100	4	III
HERNANCO DISTRICT SCHOOLS	371200	4	III
HIGHLANDS COUNTY	381000	5	III
AVON PARK	381100	5	III
LAKE PLACID	381200	5	III
SEBRING	381300	5	III
HIGHLANDS DISTRICT SCHOOLS	381400	5	III
SOUTH FLORIDA COMMUNITY COLLEGE	381500	5	III
HILLSBOROUGH COUNTY	391000	4	II
PLANT CITY	391100	4	II
TAMPA	391200	4	II
TEMPLE TERRACE	391300	4	II
HILLSBOROUGH DISTRICT SCHOOLS	391400	4	II
HILLSBOROUGH COMMUNITY COLLEGE	391500	4	II
UNIVERSITY OF SOUTH FLORIDA	391600	4	II
HOLMES COUNTY	401000	1	III
HOLMES DISTRICT SCHOOLS	401100	1	III
INDIAN RIVER COUNTY	411000	6	III
FELLSMERE	411100	6	III
ORCHID	411300	6	III
SEBASTIAN	411400	6	III
INDIAN RIVER DISTRICT SCHOOLS	411500	6	III
INDIAN RIVER COMMUNITY COLLEGE	411600	6	III

JACKSON COUNTY	421000	1	III
JACKSON DISTRICT SCHOOLS	421100	1	III
CHIPOLA JUNIOR COLLEGE	421200	1	III
GREENWOOD	421700	1	III
JEFFERSON COUNTY	431000	2	III
JEFFERSON DISTRICT SCHOOLS	431100	2	III
LAFAYETTE COUNTY	441000	2	III
MAYO	441100	2	III
LAFAYETTE DISTRICT SCHOOLS	441200	2	III
LAKE COUNTY	451000	5	III
EUSTIS	451300	5	III
FRUITLAND PARK	451400	5	III
GROVELAND	451500	5	III
HOWEY IN THE HILLS	451600	5	III
LADY LAKE	451700	5	III
LEESBURG	451800	5	III
MASCOTTE	451900	5	III
MOUNT DORA	452200	5	III
TAVARES	452300	5	III
UMATILLA	452400	5	III
LAKE DISTRICT SCHOOLS	452500	5	III
LAKE-SUMTER COMMUNITY COLLEGE	452600	5	III
LEE COUNTY	461000	7	III
CAPE CORAL	461100	7	III
FORT MYERS	461200	7	III
SANIBEL	461300	7	III
LEE DISTRICT SCHOOLS	461400	7	III
EDISON COMMUNITY COLLEGE	461500	7	III
GULF COAST UNIVERSITY	461600	7	III
LEON COUNTY	471000	2	III
TALLAHASSEE	471100	2	III
FLORIDA STATE UNIVERSITY	471200	2	III
TALLAHASSEE COMMUNITY COLLEGE	471300	2	III
LEON DISTRICT SCHOOLS	471300	2	III
FLORIDA A&M UNIVERSITY	471400	2	III
LEVY COUNTY	481000	4	III
CEDAR KEY	481200	4	III
CHIEFLAND	481300	4	III
INGLIS	481400	4	III
OTTER CREEK	481500	4	III
WILLISTON	481600	4	III
LEVY DISTRICT SCHOOLS	481700	4	III
LIBERTY COUNTY	491000	2	III
LIBERTY DISTRICT SCHOOLS	491100	2	III

MADISON COUNTY	501000	2	III
MADISON DISTRICT SCHOOLS	501100	2	III
LEE	501200	2	III
NORTH FLORIDA COMMUNITY COLLEGE	501300	2	III
MANATEE COUNTY	511000	4	II
ANNA MARIA	511100	4	II
BRADENTON	511200	4	II
BRADENTON BEACH	511300	4	II
HOLMES BEACH	511400	4	II
LONGBOAT KEY	511500	4	II
PALMETTO	511600	4	II
MANATEE DISTRICT SCHOOLS	511700	4	II
MANATEE COMMUNITY COLLEGE	511800	4	II
MARION COUNTY	521000	5	II
BELLEVIEW	521100	5	II
DUNNELLON	521200	5	II
MCINTOSH	521300	5	II
OCALA	521400	5	II
MARION DISTRICT SCHOOLS	521500	5	II
CENTRAL FLORIDA COMMUNITY COLLEGE	521600	5	II
MARTIN COUNTY	531000	8	II
JUPITER ISLAND	531100	8	II
OCEAN BREEZE PARK	531200	8	II
SEWALLS POINT	531300	8	II
STUART	531400	8	II
MARTIN DISTRICT SCHOOLS	531500	8	II
MIAMI-DADE COUNTY	231000	8	III
BAL HARBOUR VILLAGE	231100	8	III
BAY HARBOR ISLANDS	231200	8	III
BISCAYNE PARK	231300	8	III
CORAL GABLES	231400	8	III
DORAL	231410	8	III
EL PORTAL	231500	8	III
FLORIDA CITY	231600	8	III
GOLDEN BEACH	231700	8	III
HIALEAH	231800	8	III
HIALEAH GARDENS	231900	8	III
HOMESTEAD	232000	8	III
INDIAN CREEK VILLAGE	232100	8	III
ISLANDIA	232200	8	III
KEY BISCAYNE	233700	8	III
MEDLEY	232300	8	III
MIAMI	232400	8	III
MIAMI BEACH	232500	8	III

MIAMI GARDENS	232510	8	III
MIAMI SHORES VILLAGE	232600	8	III
MIAMI SPRINGS	232700	8	III
NORTH BAY VILLAGE	232800	8	III
NORTH MIAMI	233000	8	III
NORTH MIAMI BEACH	232900	8	III
OPA LOCKA	233100	8	III
PALMETTO BAY	233110	8	III
PENNSUCO	233200	8	III
PINECREST	233250	8	III
SOUTH MIAMI	233300	8	III
SUNNY ISLES BEACH	233700	8	III
SURFSIDE	233400	8	III
SWEETWATER	233500	8	III
VIRGINIA GARDENS	233600	8	III
MIAMI-DADE DISTRICT SCHOOLS	233800	8	III
MIAMI-DADE COMMUNITY COLLEGE	233900	8	III
FLORIDA INTERNATIONAL UNIVERSITY	234000	8	III
MONROE COUNTY	541000	7	III
KEY COLONY BEACH	541100	7	III
KEY WEST	541200	7	III
LAYTON	541300	7	III
MARATON	541400	7	III
MONROE DISTRICT SCHOOLS	541500	7	III
FLORIDA KEYS COMMUNITY COLLEGE	541600	7	III
NASSAU COUNTY	551000	3	III
CALLAHAN	551100	3	III
FERNANDINA BEACH	551200	3	III
HILLIARD	551300	3	III
NASSAU DISTRICT SCHOOLS	551400	3	III
OKALOOSA COUNTY	561000	1	II
CRESTVIEW	561400	1	II
DESTIN	561200	1	II
FORT WALTON BEACH	561300	1	II
MARY ESTHER	561500	1	II
NICEVILLE	561600	1	II
VALPARAISO	561800	1	II
OKALOOSA DISTRICT SCHOOLS	561900	1	II
OKALOOSA-WALTON COMMUNITY COLLEGE	562000	1	II
OKEECHOOBEE COUNTY	571000	5	III
OKEECHOOBEE	571100	5	III
OKEECHOBEE DISTRICT SCHOOLS	571200	5	III
ORANGE COUNTY	581000	5	II
APOPKA	581100	5	II

BAY LAKE	581200	5	II
EATONVILLE	581400	5	II
EDGEWOOD	581500	5	II
LAKE BUENA VISTA	581600	5	II
MAITLAND	581800	5	II
OAKLAND	581900	5	II
OCOEE	582000	5	II
ORLANDO	582100	5	II
WINTER GARDEN	582300	5	II
WINTER PARK	582400	5	II
ORANGE DISTRICT SCHOOLS	582500	5	II
UNIVERSITY OF CENTRAL FLORIDA	582600	5	II
VALENCIA COMMUNITY COLLEGE	582700	5	II
OSCEOLA COUNTY	591000	5	II
KISSIMMEE	591100	5	II
ST CLOUD	591200	5	II
OSCEOLA DISTRICT SCHOOLS	591300	5	II
PALM BEACH COUNTY	601000	8	I
ATLANTIS	601100	8	I
BELLE GLADE	601200	8	I
BOCA RATON	601300	8	I
BOYNTON BEACH	601400	8	I
BRINY BREEZES	601500	8	I
CLOUD LAKE	601600	8	I
DELRAY BEACH	601700	8	I
GLEN RIDGE	601800	8	I
GOLF	601900	8	I
GOLFVIEW	602000	8	I
GREENACRES CITY	602100	8	I
HAVERHILL	602300	8	I
HIGHLAND BEACH	602400	8	I
HYPOLUXO	602500	8	I
JUPITER	602700	8	I
LAKE CLARKE SHORE	602900	8	I
LAKE PARK	603000	8	I
LAKE WORTH	603100	8	I
LANTANA	603200	8	I
MANALAPAN	603300	8	I
MANGONIA PARK	603400	8	I
NORTH PALM BEACH	603500	8	I
OCEAN RIDGE	603600	8	I
PAHOKEE	603700	8	I
PALM BEACH	603800	8	I
PALM BEACH GARDENS	603900	8	I

PALM BEACH SHORES	604000	8	I
PALM SPRINGS	604100	8	I
RIVIERA BEACH	604200	8	I
ROYAL PALM BEACH	604300	8	I
SOUTH PALM BEACH	604500	8	I
TEQUESTA	604600	8	I
WELLINGTON	604650	8	I
WEST PALM BEACH	604700	8	I
PALM BEACH DISTRICT SCHOOLS	604800	8	I
PALM BEACH COMMUNITY COLLEGE	604900	8	I
FLORIDA ATLANTIC UNIVERSITY	605100	8	I
PASCO COUNTY	611000	4	I
DADE CITY	611100	4	I
NEW PORT RICHEY	611200	4	I
PORT RICHEY	611300	4	I
ST. LEO	611400	4	I
ZEPHYRHILLS	611600	4	I
PASCO DISTRICT SCHOOLS	611700	4	I
PASCO-HERNANDO COMMUNITY COLLEGE	611800	4	I
PINELLAS COUNTY	621000	4	I
BELLEAIR	621100	4	I
BELLEAIR BEACH	621200	4	I
CLEARWATER	621500	4	I
DUNEDIN	621600	4	I
GULFPORT	621700	4	I
INDIAN ROCK BEACH	621800	4	I
INDIAN SHORES	621900	4	I
KENNETH CITY	622000	4	I
LARGO	622100	4	I
MADEIRA BEACH	622200	4	I
NORTH REDINGTON BEACH	622300	4	I
OLDSMAR	622400	4	I
PINELLAS PARK	622500	4	I
REDINGTON BEACH	622600	4	I
REDINGTON SHORES	622700	4	I
SAFETY HARBOR	622800	4	I
ST PETERSBURG	622900	4	I
ST PETERSBURG BEACH	623000	4	I
SEMINOLE	623100	4	I
SOUTH PASADENA	623200	4	I
TARPON SPRINGS	623300	4	I
TREASURE ISLAND	623400	4	I
PINELLAS DISTRICT SCHOOLS	623500	4	I
ST PETERSBURG JUNIOR COLLEGE	623600	4	I

POLK COUNTY	631000	5	I
AUBURNDALE	631100	5	I
BARTOW	631200	5	I
DAVENPORT	631300	5	I
DUNDEE	631400	5	I
EAGLE LAKE	631500	5	I
FORT MEADE	631600	5	I
FROSTPROOF	631700	5	I
HAINES CITY	631800	5	I
LAKE ALFRED	632100	5	I
LAKE HAMILTON	632200	5	I
LAKELAND	632300	5	I
LAKE WALES	632400	5	I
MULBERRY	632500	5	I
POLK CITY	632600	5	I
WINTER HAVEN	632700	5	I
POLK DISTRICT SCHOOLS	632800	5	I
POLK COMMUNITY COLLEGE	632900	5	I
PUTNAM COUNTY	641000	3	III
PALATKA	641300	3	III
PUTNAM DISTRICT SCHOOLS	641400	3	III
ST JOHNS COUNTY	651000	3	I
ST AUGUSTINE	651200	3	I
ST AUGUSTINE BEACH	651300	3	I
ST JOHNS DISTRICT SCHOOLS	651400	3	I
ST JOHNS RIVER COMMUNITY COLLEGE	651500	3	I
ST LUCIE COUNTY	661000	6	II
FORT PIERCE	661100	6	II
PORT ST LUCIE	661200	6	II
ST LUCIE VILLAGE	661300	6	II
ST LUCIE DISTRICT SCHOOLS	661400	6	II
SANTA ROSA COUNTY	671000	1	II
GULF BREEZE	671100	1	II
JAY	671200	1	II
MILTON	671300	1	II
SANTA ROSA DISTRICT SCHOOLS	671400	1	II
SARASOTA COUNTY	681000	4	II
NORTH PORT	681100	4	II
SARASOTA	681200	4	II
VENICE	681300	4	II
SARASOTA DISTRICT SCHOOLS	681400	4	II
SEMINOLE COUNTY	691000	5	I
ALTAMONTE SPRINGS	691100	5	I
CASSELBERRY	691200	5	I

LONGWOOD	691300	5	I
OVIEDO	691400	5	I
SANFORD	691500	5	I
WINTER SPRINGS	691600	5	I
LAKE MARY	691700	5	I
SEMINOLE DISTRICT SCHOOLS	691800	5	I
SEMINOLE COMMUNITY COLLEGE	691900	5	I
SEMINOLE INDIAN TRIBE	692000	5	III
SUMTER COUNTY	701000	5	II
BUSHNELL	701100	5	II
CENTER HILL	701200	5	II
COLEMAN	701300	5	II
WILDWOOD	701400	5	II
SUMTER DISTRICT SCHOOLS	701500	5	II
SUWANNEE COUNTY	711000	2	III
BRANFORD	711100	2	III
LIVE OAK	711200	2	III
SUWANNEE DISTRICT SCHOOLS	711300	2	III
TAYLOR COUNTY	721000	2	II
PERRY	721100	2	II
TAYLOR DISTRICT SCHOOLS	721200	2	II
UNION COUNTY	731000	3	II
UNION DISTRICT SCHOOLS	731100	3	II
VOLUSIA COUNTY	741000	6	I
DAYTONA BEACH	741100	6	I
DAYTONA BEACH SHORES	741200	6	I
DELAND	741300	6	I
EDGEWATER	741400	6	I
HOLLY HILL	741500	6	I
LAKE HELEN	741600	6	I
NEW SMYRNA BEACH	741700	6	I
OAK HILL	741800	6	I
ORANGE CITY	741900	6	I
ORMAND BEACH	742000	6	I
PIERSON	742100	6	I
PONCE INLET	742200	6	I
PORT ORANGE	742300	6	I
SOUTH DAYTONA	742400	6	I
VOLUSIA DISTRICT SCHOOLS	742500	6	I
DAYTONA BEACH COMMUNITY COLLEGE	742600	6	I
WAKULLA COUNTY	751000	2	II
WAKULLA DISTRICT SCHOOLS	751100	2	II
WALTON COUNTY	761000	1	II
DEFUNIAK SPRINGS	761100	1	II

WALTON DISTRICT SCHOOLS	761200	1	II
WASHINGTON COUNTY	771000	1	II
WASHINGTON DISTRICT SCHOOLS	771100	1	II

APPENDIX 13-B

SUPPLEMENTAL INFORMATION FOR SUBCHAPTER 13-4

B1.0 General requirements.

B1.1 Testing procedures.

B1.1.1 Building material thermal properties. If building material *R*-values or thermal conductivities are determined by testing, one of the following test procedures shall be used:

a. ASTM C 177,

b. ASTM C 236,

c. ASTM C 518, or

d. ASTM C 976.

For concrete, the oven-dried conductivity shall be multiplied by 1.2 to reflect the moisture content as typically installed.

B1.1.2 Assembly *U*-factors. If assembly *U*-factors are determined by testing, one of the following test procedures shall be used:

a. ASTM C 236 or

b. ASTM C 976.

Product samples tested shall be production line material or representative of material as purchased by the consumer or contractor. If the assembly is too large to be tested at one time in its entirety, then either a representative portion shall be tested or different portions shall be tested separately and a weighted average determined. To be representative, the portion tested shall include edges of panels, joints with other panels, typical framing percentages, and thermal bridges.

B1.1.3 Fenestrations and doors. Product samples used for determining fenestration performance shall be production line units or representative of units as purchased by the consumer or contractor.

B1.2 Calculation procedures and assumptions. The following procedures and assumptions shall be used for all calculations. *R*-values for air films, insulation, and building materials shall be taken from Sections B1.2.1 through B1.2.3, respectively. In addition, the appropriate assumptions listed in Sections B2.1 through B2.5, including framing factors, shall be used.

B1.2.1 Air films. Prescribed *R*-values for air films shall be as follows:

R-value	Condition
0.17	All exterior surfaces
0.46	All semiexterior surfaces
0.61	Interior horizontal surfaces, heat flow up
0.92	Interior horizontal surfaces, heat flow down
0.68	Interior vertical surfaces

B1.2.1.1 Exterior surfaces are areas exposed to the wind.

B1.2.1.2 Semiexterior surfaces are protected surfaces that face attics, crawl spaces, and parking garages with natural or mechanical ventilation.

B1.2.1.3 Interior surfaces are surfaces within enclosed spaces.

B1.2.1.4 The *R*-value for cavity airspaces shall be taken from Table B-1 based on the emissivity of the cavity from Table B-2. No credit shall be given for airspaces in cavities that contain any insulation or less than $^1/_2$ inch (12.7 mm). The values for $3^1/_2$-inch (84 mm) cavities shall be used for cavities of that width and greater.

B1.2.2 Insulation *R*-values. Insulation *R*-values shall be determined as follows:

a. For insulation that is not compressed, the rated *R*-value of insulation shall be used.

b. For calculation purposes, the effective *R*-value for insulation that is uniformly compressed in confined cavities shall be taken from Table B-3.

c. For calculation purposes, the effective *R*-value for insulation installed in cavities in attic roofs with steel joists shall be taken from Table B-18.

d. For calculation purposes, the effective *R*-value for insulation installed in cavities in steel-framed walls shall be taken from Table B-17.

B1.2.3 Building material thermal properties. *R*-values for building materials shall be taken from Table B-4. Concrete block *R*-values shall be calculated using the isothermal planes method or a two-dimensional calculation program, thermal conductivities from Table B-5 and dimensions from ASTM C 90. The parallel path calculation method is not acceptable.

Exception: *R*-values for building materials or thermal conductivities determined from testing in accordance with Section B-1.1

B1.2.4 Building material heat capacitie: The heat capacity of assemblies shall be calculated using published values for the unit weight and specific heat of all building material components that make up the assembly.

B1.2.5 Architectural drawings. All components of the building envelope in the proposed design shall be modeled as shown on architectural drawings or as installed for existing building envelopes.

Exceptions: The following building elements are permitted to differ from architectural drawings.

1. Any envelope assembly that covers less than 5 percent of the total area of that assembly type (e.g., exterior walls) need not be separately described. If not separately described, the area of an envelope assembly must be added to the area of the adjacent assembly of that same type.

2. Exterior surfaces whose azimuth orientation and tilt differ by no more than 45 degrees and are otherwise the ame may be described as either a single surface or by using multipliers.

B1.3 Insulation installation. Insulation materials shall be installed in accordance with the insulation installation standards listed in table 6C-2 of Appendix 13-C and in such a manner as to achieve *rated R-value of insulation*. Open-blown or poured loose-fill insulation shall not be used in attic roof spaces when the slope of the ceiling is more than 3:12. When eave vents are installed, baffling of the vent openings shall be provided to deflect the incoming air above the surface of the insulation.

Exception: Where *metal building roof* and *metal building wall* insulation is compressed between the roof or wall skin and the structure.

B1.3.1 Substantial contact. Insulation shall be installed in a permanent manner in *substantial contact* with the inside surface in accordance with manufacturer's recommendations for the framing system used. Flexible batt insulation installed in floor cavities shall be supported in a permanent manner by supports no greater than 24 inches (610 mm) on center (o.c.).

Exception: Insulation materials that rely on airspaces adjacent to reflective surfaces for their rated performance.

B1.3.2 Recessed equipment. Lighting fixtures; heating, ventilating, and air-conditioning equipment, including wall heaters, ducts, and plenums; and other equipment shall not be recessed in such a manner as to affect the insulation thickness unless:

1. The total combined area affected (including necessary clearances) is less than one percent of the opaque area of the assembly,
2. The entire *roof*, *wall*, or *floor* is covered with insulation to the full depth required,
3. The effects of reduced insulation are included in calculations using an area-weighted average method and compressed insulation values obtained from Table B-3.

In all cases, air leakage through or around the recessed equipment to the conditioned space shall be limited in accordance with Section 406.ABC.1.2.

B1.3.3 Insulation protection. Exterior insulation shall be covered with a protective material to prevent damage from sunlight, moisture, landscaping operations, equipment maintenance, and wind. In *attics* and mechanical rooms, a way to access equipment that prevents damaging or compressing the insulation shall be provided. Foundation vents shall not interfere with the insulation. Insulation materials in ground contact shall have a water absorption rate no greater than 0.3 percent when tested in accordance with ASTM C 272.

B1.4 Assembly *U*-factor, C-factor and F-factor determination.

B1.4.1 Precalculated assembly *U*-factors, C-factors, F-factors, or Heat capacities. The *U-factors*, *C-factors*, *F-factors*, and *heat capacities* for typical construction assemblies are included in Sections B2.1 through B2.5. These values shall be used for all calculations unless otherwise allowed by applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities. Interpolation between values in a particular table in Appendix B is allowed for *rated R-values of insulation*, including insulated sheathing. Extrapolation beyond values in this appendix is not allowed.

B1.4.2 Applicant-determined assembly *U*-Factors, C-factors, F-factors, or heat capacities. If the *building official* determines that the proposed construction assembly is not adequately represented in Sections B2.1 through B2.5, the applicant shall determine appropriate values for the assembly using the assumptions in Section B1.5. An assembly is deemed to be adequately represented if:

a. The interior structure, hereafter referred to as the base assembly, for the *class of construction* is the same as described in Sections B2.1 through B2.5 and
b. Changes in exterior or interior surface *building materials* added to the base assembly do not increase or decrease the *R*-value by more than 2 from that indicated in the descriptions in Sections B2.1 through B2.5. Insulation, including insulated sheathing, is not considered a *building material*.

B1.5 Determination of alternate assembly *U*-factors, C-factors, F-factors, or heat capacities.

B1.5.1 General. Component *U*-factors for other opaque assemblies shall be determined in accordance with Section B1.5 only if approved by the *building official* in accordance with the applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities. The procedures required for each class of construction are specified in Section B1.5.2. Testing shall be performed in accordance with Section B1.1. Calculations shall be performed in accordance with Section B1.2.

B1.5.2 Required procedures. Two- or three-dimensional finite difference and finite volume computer models shall be an acceptable alternative method to calculating the thermal performance values for all assemblies and constructions listed below. The following procedures shall also be permitted to determine all alternative *U-factors*, *F-factors* and *C-factors*.

B1.5.2.1 Above-grade walls.

1. *Mass walls*: testing or the isothermal planes calculation method or two-dimensional calculation method. The parallel path calculation method is not acceptable.
2. *Metal building walls:* testing.
3. *Steel-framed walls*: testing or parallel path calculation method using the insulation/framing layer adjustment factors in Table B-17 or the modified zone method.
4. *Wood framed walls*: testing or parallel path calculation method.

5. Other *walls*: testing or two-dimensional calculation method.

B1.5.2.2 Below-grade walls.

(1) Mass walls: Testing or the isothermal planes calculation method or two-dimensional calculation method. The parallel path calculation method is not acceptable.

(2) Other walls: Testing or two-dimensional calculation method.

B1.5.2.3 Roofs.

1. Roofs with insulation entirely above deck: Testing or series calculation method.
2. Metal building roofs: Testing.
3. Attic roofs, wood joists: Testing or parallel path calculation method.
4. Attic roofs, steel joists: Testing or parallel path calculation method using the insulation/framing layer adjustment factors in Table B-18 or modified zone calculation method.
5. Attic roofs, concrete joists: Testing or parallel path calculation method if concrete is solid and uniform or isothermal planes calculation method if concrete has hollow sections.
6. Other attic roofs and other roofs: Testing or two dimensional calculation method.

B1.5.2.4 Floors.

1. Mass floors: Testing or parallel path calculation method if concrete is solid and uniform or isothermal planes calculation method if concrete has hollow sections.
2. Steel joist floors: Testing or modified zone calculation method.
3. Wood joist floors: Testing or parallel path calculation method or isothermal planes calculation method.
4. Other floors: Testing or two-dimensional calculation method.
5. Slab-on-grade floors: No testing or calculations allowed.

B2.0 Building envelope characteristics.

B2.1 Fenestration. All fenestration with *U*-factors, SHGC or visible light transmittance determined, certified, and labeled in accordance with NFRC 100, 200, and 300, respectively, as specified in Section B1.1.3 shall be assigned those values. *U*-factors (thermal transmittances) of fenestration products (windows, doors and skylights) shall be determined by an accredited, independent laboratory in accordance with National Fenestration Rating Council 100, *Procedure for Determining Fenestration Product U-Factors*. The solar heat gain coefficient (SHGC) for glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with National Fenestration Rating Council 200, *Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence*. Visible light transmittance shall be determined in accordance with NFRC 200 and shall be verified and certified by the manufacturer.

B2.1.1 Fenestration energy rating labels. Energy performance values (i.e. *U*-factor, solar heat gain coefficient) of fenestration products (i.e., windows, doors and skylights) shall be determined by an accredited, independent laboratory and labeled and certified by the manufacturer. Such certified and labeled fenestration energy ratings shall be accepted for the purposes of determining compliance with the building envelope requirements of this code.

B2.1.2 Unlabeled fenestrations. Where the specified energy performance (*U*-factor or solar heat gain coefficienet) of the fenestration product is not labeled nor readily apparent, the default procedures outlined in Tables B-6, B-7 and B-8 of this appendix for *U*-factor and SHGC shall be used to determine code compliance by Subchapter 4. Product features must be verifiable for the product to qualify for the default value associated with those features. Where the existence of a particular feature cannot be determined with reasonable certainty, the product shall not receive credit for that feature. Where a composite of materials from two different product types are used, the product shall be assigned the worst value.

B2.1.2.1 Unlabeled skylights. Unlabeled skylights shall be assigned the *U*-factors in Table B-6 and are allowed to use the SHGCs and visible light transmittances in Table B-7. The metal with thermal break frame category shall not be used unless all frame members have a thermal break equal to or greater than $^1/_4$ inch (6 mm).

B2.1.2.2 Unlabeled vertical fenestration. Unlabeled vertical fenestration, both operable and fixed, shall be assigned the *U*-factors, SHGCs, and visible light transmittances in Table B-8. No credit shall be given for any other features, including metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers, other than as determined in accordance with Section B1.1.3.

B2.1.3 Shading devices.

B2.1.3.1 Overhangs. Shading may be by recessing the glazing into the building structure by permanently mounted overhangs and projections or by permanently mounted sun shades with adequate air movement between the shading device and the fenestration. Complying overhangs shall be completely opaque and have the effect of being solid. Overhangs with slots, slats, grids and other openings are not considered if the sun can penetrate through at any occurring angle. Overhangs shall extend horizontally to points even with the left and right sides of the glazing.

B2.1.3.2 Shell buildings. Only those shading devices that are installed at the time of construction of the building shell shall be considered when determining compliance for shell buildings.

B2.2 Walls.

B2.2.1 Above-grade walls.

B2.2.1.1 Mass wall. *U*-factors for mass walls shall be taken from Table B-9 or determined by the procedure in

TABLE B-1
EMITTANCE VALUES OF VARIOUS SURFACES AND EFFECTIVE EMITTANCES OF AIR SPACES

Surface	Average Emittance *e*	Effective Emittance e eff of Air Space	
		One Surface *e*; Other, 0.9	Both Surfaces Emittance *e*
Aluminum foil,bright	0.05	0.05	0.03
Aluminum foil,with condensate just visible (> 0.7gr/ft^2)	0.3	0.29	—
Aluminum foil,with condensate clearly visible (> 2.9gr/ft^2)	0.7	0.65	—
Aluminum sheet	0.12	0.12	0.06
Aluminum coated paper, polished	0.2	0.2	0.11
Steel, galv., bright	0.25	0.24	0.15
Aluminum paint	0.5	0.47	0.35
Bldg materials: wood, paper, masonry, nonmetallic paints	0.9	0.82	0.82
Regular glass	0.84	0.77	0.72

TABLE B-2
R-VALUES FOR CAVITY AIR SPACES

Component	Airspace Thickness (in.)	*R*-Value, Effective Emissivity				
		0.03	0.05	0.20	0.50	0.82
Roof	0.5	2.13	2.04	1.54	1.04	0.77
	0.75	2.33	2.22	1.64	1.09	0.8
	1.5	2.53	2.41	1.75	1.13	0.82
	3.5	2.83	2.66	1.88	1.19	0.85
Wall	0.5	2.54	2.43	1.75	1.13	0.82
	0.75	3.58	3.32	2.18	1.3	0.9
	1.5	3.92	3.62	2.3	1.34	0.93
	3.5	3.67	3.4	2.21	1.31	0.91
Floor	0.5	2.55	1.28	1	0.69	0.53
	0.75	1.44	1.38	1.06	0.73	0.54
	1.5	2.49	2.38	1.76	1.15	0.85
	3.5	3.08	2.9	2.01	1.26	0.9

For SI: 1 inch = 25.4 mm.

TABLE B-3
EFFECTIVE *R*-VALUES FOR FIBERGLASS

INSULATION *R*-VALUE AT STANDARD THICKNESS								
Rated R-Value		38	30	22	21	19	15	13	11
Standard Thickness (in.)		12	9.5	6.5	5.5	6	3.5	3.5	3.5
Nominal Lumber Size (in.)	Actual Depth of Cavity (in.)	Effective insulation *r*-values when installed in a confined cavity							
2x12	11.25	37	—	—	—	—	—	—	—
2x10	9.25	32	30	—	—	—	—	—	—
2x8	7.25	27	26	22	21	19	—	—	—
2x6	5.5	—	21	20	21	18	—	—	—
2x4	3.5	—	—	14	—	13	15	13	11
	2.5	—	—	—	—	—	—	9.8	—
	1.5	—	—	—	—	—	—	6.3	6

For SI: 1 inch = 25.4 mm.

TABLE B-4
***R*-VALUES FOR BUILDING MATERIALS**

Material	Nominal Size (in.)	Actual Size (in.)	R-Value
Concrete and rubber pad	—	—	1.23
Concrete at R-0.0625/in.	—	2	0.13
	—	4	0.25
	—	6	0.38
	—	8	0.5
	—	10	0.63
	—	12	0.75
Flooring, wood subfloor	—	0.75	0.94
Gypsum board	—	0.5	0.45
	—	0.625	0.56
Metal deck	—	—	0
Roofing, built-up	—	0.375	0.33
Sheathing, vegetable fiber board, 0.78 in.	—	0.78	2.06
Soil at R-0.104/in.	—	12	1.25
Steel, mild	—	1	0.0031807
Stucco	—	0.75	0.08
Wood, 2 × 4 at R-1.25/in.	4	3.5	4.38
Wood, 2 × 6 at R-1.25/in.	6	5.5	6.88
Wood, 2 × 8 at R-1.25/in.	8	7.25	9.06
Wood, 2 × 10 at R-1.25/in.	10	9.25	11.56
Wood, 2 × 12 at R-1.25/in.	12	11.25	14.06
Wood, 2 × 14 at R-1.25/in.	14	13.25	16.56

For SI: 1 inch = 25.4 mm.

TABLE B-5
THERMAL CONDUCTIVITY OF CONCRETE BLOCK MATERIAL

Concrete Block Density in lb/ft^3	Thermal Conductivity in Btu·in./h·ft^2·°F
80	3.7
85	4.2
90	4.7
95	5.1
100	5.5
105	6.1
110	6.7
115	7.2
120	7.8
125	8.9
130	10
135	11.8
140	13.5

TABLE B-6
ASSEMBLY *U*-FACTORS FOR UNLABELED SKYLIGHTS

Product Type		Sloped Installation						
		Unlabeled Skylight with Curb (Includes glass/plastic, flat/domed, fixed/operable)				Unlabeled Skylight without Curb (Includes glass/plastic, flat/domed, fixed/operable)		
Frame Type		Aluminum without Thermal Break	Aluminum with Thermal Break	Reinforced Vinyl/ Aluminum Clad Wood	Wood/ Vinyl	Aluminum without Thermal Break	Aluminum with Thermal Break	Structural Glazing
ID	Glazing Type							
	Single Glazing							
1	1/8" glass	1.98	1.89	1.75	1.47	1.36	1.25	1.25
2	1/4" acrylic/polycarb	1.82	1.73	1.60	1.31	1.21	1.10	1.10
3	1/8" acrylic/polycarb	1.90	1.81	1.68	1.39	1.29	1.18	1.18
	Double Glazing							
4	1/4" airspace	1.31	1.11	1.05	0.84	0.82	0.70	0.66
5	1/2" airspace	1.30	1.10	1.04	0.84	0.81	0.69	0.65
6	1/4" argon space	1.27	1.07	1.00	0.80	0.77	0.66	0.62
7	1/2" argon space	1.27	1.07	1.00	0.80	0.77	0.66	0.62
	Double Glazing, *e* = 0.60 on surface 2 or 3							
8	1/4" airspace	1.27	1.08	1.01	0.81	0.78	0.67	0.63
9	1/2" airspace	1.27	1.07	1.00	0.80	0.77	0.66	0.62
10	1/4" argon space	1.23	1.03	0.97	0.76	0.74	0.63	0.58
11	1/2" argon space	1.23	1.03	0.97	0.76	0.74	0.63	0.58
	Double Glazing, *e* =0.40 on surface 2 or 3							
12	1/4" airspace	1.25	1.05	0.99	0.78	0.76	0.64	0.6
13	1/2" airspace	1.24	1.04	0.98	0.77	0.75	0.64	0.59
14	1/4" argon space	1.18	0.99	0.92	0.72	0.70	0.58	0.54
15	1/2" argon space	1.2	1	0.94	0.74	0.71	0.6	0.56
	Double Glazing, *e* = 0.20 on surface 2 or 3							
16	1/4" airspace	1.20	1.00	0.94	0.74	0.71	0.60	0.56
17	1/2" airspace	1.20	1.00	0.94	0.74	0.71	0.60	0.56
18	1/4" argon space	1.14	0.94	0.88	0.68	0.65	0.54	0.50
19	1/2" argon space	1.15	0.95	0.89	0.68	0.66	0.55	0.51
	Double Glazing, *e* = 0.10 on surface 2 or 3							
20	1/4" airspace	1.18	0.99	0.92	0.72	0.70	0.58	0.54
21	1/2" airspace	1.18	0.99	0.92	0.72	0.70	0.58	0.54
22	1/4" argon space	1.11	0.91	0.85	0.65	0.63	0.52	0.47
23	1/2" argon space	1.13	0.93	0.87	0.67	0.65	0.53	0.49
	Double Glazing, *e* = 0.05 on surface 2 or 3							
24	1/4" airspace	1.17	0.97	0.91	0.70	0.68	0.57	0.52
25	1/2" airspace	1.17	0.98	0.91	0.71	0.69	0.58	0.53
26	1/4" argon space	1.09	0.89	0.83	0.63	0.61	0.50	0.45
27	1/2" argon space	1.11	0.91	0.85	0.65	0.63	0.52	0.47
	Triple Glazing							
28	1/4" airspaces	1.12	0.89	0.84	0.64	0.64	0.53	0.48
29	1/2" airspaces	1.10	0.87	0.81	0.61	0.62	0.51	0.45
30	1/4" argon spaces	1.09	0.86	0.80	0.60	0.61	0.50	0.44
31	1/2" argon spaces	1.07	0.84	0.79	0.59	0.59	0.48	0.42
	Triple Glazing, e=0.20 on surface 2,3,4, or 5							
32	1/4" airspaces	1.08	0.85	0.79	0.59	0.60	0.49	0.43
33	1/2" airspaces	1.05	0.82	0.77	0.57	0.57	0.46	0.41
34	1/4" argon spaces	1.02	0.79	0.74	0.54	0.55	0.44	0.38
35	1/2" argon spaces	1.01	0.78	0.73	0.53	0.54	0.43	0.37
	Triple Glazing, e=0.20 on surfaces 2 or 3 and 4 or 5							
36	1/4" airspaces	1.03	0.80	0.75	0.55	0.56	0.45	0.39
37	1/2" airspaces	1.01	0.78	0.73	0.53	0.54	0.43	0.37
38	1/4" argon spaces	0.99	0.75	0.70	0.50	0.51	0.40	0.35
39	1/2" argon spaces	0.97	0.74	0.69	0.49	0.50	0.39	0.33
	Triple Glazing, e=0.10 on surfaces 2 or 3 and 4 or 5							
40	1/4" airspaces	1.01	0.78	0.73	0.53	0.54	0.43	0.37
41	1/2" airspaces	0.99	0.76	0.71	0.51	0.52	0.41	0.36
42	1/4" argon spaces	0.96	0.73	0.68	0.48	0.49	0.38	0.32
43	1/2" argon spaces	0.95	0.72	0.67	0.47	0.48	0.37	0.31
	Quadruple Glazing, e=0.10 on surfaces 2 or 3 and 4 or 5							
44	1/4" airspaces	0.97	0.74	0.69	0.49	0.50	0.39	0.33
45	1/2" airspaces	0.94	0.71	0.66	0.46	0.47	0.36	0.30
46	1/4" argon spaces	0.93	0.70	0.65	0.45	0.46	0.35	0.30
47	1/2" argon spaces	0.91	0.68	0.63	0.43	0.44	0.33	0.28
48	1/4" krypton spaces	0.88	0.65	0.60	0.40	0.42	0.31	0.25

For SI: 1 inch = 25.4 mm.

TABLE B-7
ASSEMBLY SOLAR HEAT GAIN COEFFICIENTS (SHGC) AND ASSEMBLY VISIBLE LIGHT TRANSMITTANCES (VLT) FOR UNLABELED SKYLIGHTS

Glass Type	Glazing Type: Number of glazing layers Number & emissivity of coatings (glazing is glass except where noted)	Unlabeled Skylights (includes glass/plastic, flat/domed, fixed/operable)					
	Frame	Metal without thermal break		Metal with thermal break		Wood/vinyl/ fiberglass	
	Characteristic	SHGC	VLT	SHGC	VLT	SHGC	VLT
Clear	Single glazing, 1/8 in. glass	0.82	0.76	0.78	0.76	0.73	0.73
	Single glazing, 1/4 in. glass	0.78	0.75	0.74	0.75	0.69	0.72
	Single glazing, acrylic/polycarbonate	0.83	0.92	0.83	0.92	0.83	0.92
	Double glazing	0.68	0.66	0.64	0.66	0.59	0.64
	Double glazing, E=0.40 on surface 2 or 3	0.71	0.65	0.67	0.65	0.62	0.63
	Double glazing, E=0.20 on surface 2 or 3	0.66	0.61	0.62	0.61	0.57	0.59
	Double glazing, E=0.10 on surface 2 or 3	0.59	0.63	0.55	0.63	0.51	0.61
	Double glazing, acrylic/polycarbonate	0.77	0.89	0.77	0.89	0.77	0.89
	Triple glazing	0.60	0.59	0.56	0.59	0.52	0.57
	Triple glazing, E=0.40 on surface 2, 3, 4, or 5	0.64	0.60	0.60	0.60	0.56	0.57
	Triple glazing, E=0.20 on surface 2, 3, 4, or 5	0.59	0.55	0.55	0.55	0.51	0.53
	Triple glazing, E=0.10 on surface 2, 3, 4, or 5	0.54	0.56	0.50	0.56	0.46	0.54
	Triple glazing, E=0.40 on surfaces 3 and 5	0.62	0.57	0.58	0.57	0.53	0.55
	Triple glazing, E=0.20 on surfaces 3 and 5	0.56	0.51	0.52	0.51	0.48	0.49
	Triple glazing, E=0.10 on surfaces 3 and 5	0.47	0.54	0.43	0.54	0.40	0.52
	Triple glazing, acrylic/polycarbonate	0.71	0.85	0.71	0.85	0.71	0.85
	Quadruple glazing, E=0.10 on surfaces 3 and 5	0.41	0.48	0.37	0.48	0.33	0.46
	Quadruple glazing, acrylic/polycarbonate	0.65	0.81	0.65	0.81	0.65	0.81
Tinted	Single glazing, 1/8 in. glass	0.70	0.58	0.66	0.58	0.62	0.56
	Single glazing, 1/4 in. glass	0.61	0.45	0.56	0.45	0.52	0.44
	Single glazing, acrylic/polycarbonate	0.46	0.27	0.46	0.27	0.46	0.27
	Double glazing	0.50	0.40	0.46	0.40	0.42	0.39
	Double glazing, E=0.40 on surface 2 or 3	0.59	0.50	0.55	0.50	0.50	0.48
	Double glazing, E=0.20 on surface 2 or 3	0.47	0.37	0.43	0.37	0.39	0.36
	Double glazing, E=0.10 on surface 2 or 3	0.43	0.38	0.39	0.38	0.35	0.37
	Double glazing, acrylic/polycarbonate	0.37	0.25	0.37	0.25	0.37	0.25
	Triple glazing	0.42	0.22	0.37	0.22	0.34	0.21
	Triple glazing, E=0.40 on surface 2, 3, 4, or 5	0.53	0.45	0.49	0.45	0.45	0.44
	Triple glazing, E=0.20 on surface 2, 3, 4, or 5	0.42	0.33	0.38	0.33	0.35	0.32
	Triple glazing, E=0.10 on surface 2, 3, 4, or 5	0.39	0.34	0.35	0.34	0.31	0.33
	Triple glazing, E=0.40 on surfaces 3 and 5	0.51	0.43	0.47	0.43	0.43	0.42
	Triple glazing, E=0.20 on surfaces 3 and 5	0.40	0.31	0.36	0.31	0.32	0.29
	Triple glazing, E=0.10 on surfaces 3 and 5	0.34	0.32	0.30	0.32	0.27	0.31
	Triple glazing, acrylic/polycarbonate	0.30	0.23	0.30	0.23	0.30	0.23
	Quadruple glazing, E=0.10 on surfaces 3 and 5	0.30	0.29	0.26	0.29	0.23	0.28
	Quadruple glazing, acrylic/polycarbonate	0.27	0.25	0.27	0.25	0.27	0.25

For SI: 1 inch = 25.4 mm.

TABLE B-8
ASSEMBLY *U*-FACTORS, ASSEMBLY SOLAR HEAT GAIN COEFFICIENTS (SHGC), AND ASSEMBLY VISIBLE LIGHT TRANSMITTANCES (VLT) FOR UNLABELED VERTICAL FENESTRATION

	Unlabeled Vertical Fenestration					
	Clear Glass			Tinted Glass		
	U-Factor	SHGC	VLT	*U*-Factor	SHGC	VLT
All frame types						
Single glazing	1.25	0.82	0.76	1.25	0.70	0.58
Glass block	0.60	0.56	0.56	n.a.	n.a.	n.a.
Wood, vinyl, or fiberglass frame						
Double glazing	0.60	0.59	0.64	0.60	0.42	0.39
Triple glazing	0.45	0.52	0.57	0.45	0.34	0.21
Metal and other frame types						
Double glazing	0.90	0.68	0.66	0.90	0.50	0.40
Triple glazing	0.70	0.60	0.59	0.70	0.42	0.22

this subsection. It is acceptable to use the *U*-factors in Table B-9 for all mass walls, provided that the grouting is equal to or less than that specified. Heat capacity for mass walls shall be taken from Table B-10 or B-11.

Exception: *U*-factors for mass walls determined in accordance with Section B2.2.1.1.3.

B2.2.1.1.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a masonry or concrete wall. Continuous insulation is installed on the interior, exterior, or within the masonry units, or it is installed on the interior or exterior of the concrete. The *U*-factor includes R-0.17 for exterior air film and R-0.68 for interior air film, vertical surfaces. For insulated walls, the *U*-factor also includes R-0.45 for $^1/_2$-inch (12.7 mm) gypsum board. *U*-factors are provided for the following configurations:

a. Concrete wall: 8 inches (203 mm) normal weight concrete wall with a density of 145 pound per cubic foot (2323 kg/m^3).
b. Solid grouted concrete block wall: 8 inches (203 mm) medium weight ASTM C 90 concrete block with a density of 115 pound per cubic foot (1842 kg/m^3) and solid grouted cores.
c. Partially grouted concrete block wall: 8 inches (205 mm) medium weight ASTM C 90 concrete block with a density of 115 pound per cubic foot (1842 kg/m^3) having reinforcing steel every 32 inches (812 mm) vertically and every 48 inches (1219 mm) horizontally, with cores grouted in those areas only. Other cores are filled with insulating material only if there is no other insulation.

B2.2.1.1.2 Mass wall rated *R*-value of insulation.

B2.2.1.1.2.1 Mass wall heat capacity shall be determined from Table B-10 or B-11.

B2.2.1.1.2.2 The rated *R*-value of insulation is for continuous insulation uninterrupted by framing other than 20 gauge 1-inch metal clops spaced no closer than 24 inches on center (609 mm) horizontally and 16 inches on center (406 mm) vertically.

B2.2.1.1.2.3 Where other framing, including metal and wood studs, is used, compliance shall be based on the maximum assembly *U*-factor.

B2.2.1.1.2.4 Where rated *R*-value of insulation is used for concrete sandwich panels, the insulation shall be continuous throughout the entire panel.

B2.2.1.1.3 Mass wall *U*-factor.

B2.2.1.1.3.1 *U*-factors for mass walls shall be taken from Table B-10 or determined by the procedure in this subsection. It is acceptable to use the *U*-factors in Table B-9 for all mass walls, provided that the grouting is equal to or less than that specified. Heat capacity for mass walls shall be taken from Table B-10 or B-11.

Exception: For mass walls, where the requirement on Form 400C is for a maximum assembly U-0.151 followed by Note a, ASTM C 90 concrete block walls, ungrouted or partially grouted at 32 inches (812 mm) or less on center vertically and 48 inches (1219 mm) or less on center horizontally, shall have ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu in./h ft^2°F. Other mass walls with integral insulation shall meet the criteria when their *U*-factors are equal to or less than those for the appropriate thickness and density in the "Partly Grouted Cells Insulated" column of Table B-11.

B2.2.1.1.3.2 Determination of mass wall *U*-factors. If not taken from Table B-9, mass wall *U*-factors shall be determined from Tables B-10, B-11, and B-12 using the following procedure.

a. If the mass wall is uninsulated or only the cells are insulated:

TABLE B-9
ASSEMBLY *U*-FACTORS FOR ABOVE-GRADE CONCRETE WALLS AND MASONRY WALLS

Framing Type and Depth	Rated *R*-Value of Insulation Alone	Assembly *U*-Factors for 8 in. Normal Weight 145 lb/ft^3 Solid Concrete Walls	Assembly *U*-Factors for 8 in. Medium Weight 115 lb/ft^3 Concrete Block Walls: Solid Grouted	Assembly *U*-Factors for 8 in. Medium Weight 115 lb/ft^3 Concrete Block Walls: Partially Grouted (cores uninsulated except where specified)
No Framing	R-0	U-0.740	U-0.580	U-0.480
	Ungrouted Cores Filled with Loose-fill insulation	N.A.	N.A.	U-0.350
Continuous metal framing at 24 in. on center horizontally				
3.5 in.	R-11.0	U-0.168	U-0.158	U-0.149
3.5 in.	R-13.0	U-0.161	U-0.152	U-0.144
3.5 in.	R-15.0	U-0.155	U-0.147	U-0.140
4.5 in.	R-17.1	U-0.133	U-0.126	U-0.121
4.5 in.	R-22.5	U-0.124	U-0.119	U-0.114
4.5 in.	R-25.2	U-0.122	U-0.116	U-0.112
5.0 in.	R-19.0	U-0.122	U-0.117	U-0.112
5.0 in.	R-25.0	U-0.115	U-0.110	U-0.106
5.0 in.	R-28.0	U-0.112	U-0.107	U-0.103
5.5 in.	R-19.0	U-0.118	U-0.113	U-0.109
5.5 in.	R-20.9	U-0.114	U-0.109	U-0.105
5.5 in.	R-21.0	U-0.113	U-0.109	U-0.105
5.5 in.	R-27.5	U-0.106	U-0.102	U-0.099
5.5 in.	R-30.8	U-0.104	U-0.100	U-0.096
6.0 in.	R-22.8	U-0.106	U-0.102	U-0.098
6.0 in.	R-30.0	U-0.099	U-0.095	U-0.092
6.0 in.	R-33.6	U-0.096	U-0.093	U-0.090
6.5 in.	R-24.7	U-0.099	U-0.096	U-0.092
7.0 in.	R-26.6	U-0.093	U-0.090	U-0.087
7.5 in.	R-28.5	U-0.088	U-0.085	U-0.083
8.0 in.	R-30.4	U-0.083	U-0.081	U-0.079
1 in. metal clips at 24 in. on center horizontally and 16 in. vertically				
1.0 in.	R-3.8	U-0.210	U-0.195	U-0.182
1.0 in.	R-5.0	U-0.184	U-0.172	U-0.162
1.0 in.	R-5.6	U-0.174	U-0.163	U-0.154
1.5 in.	R-5.7	U-0.160	U-0.151	U-0.143
1.5 in.	R-7.5	U-0.138	U-0.131	U-0.125
1.5 in.	R-8.4	U-0.129	U-0.123	U-0.118
2.0 in.	R-7.	U-0.129	U-0.123	U-0.118
2.0 in.	R-10.0	U-0.110	U-0.106	U-0.102
2.0 in.	R-11.2	U-0.103	U-0.099	U-0.096
2.5 in.	R-9.5	U-0.109	U-0.104	U-0.101
2.5 in.	R-12.5	U-0.092	U-0.089	U-0.086
2.5 in.	R-14.0	U-0.086	U-0.083	U-0.080
3.0 in.	R-11.4	U-0.094	U-0.090	U-0.088
3.0 in.	R-15.0	U-0.078	U-0.076	U-0.074
3.0 in.	R-16.8	U-0.073	U-0.071	U-0.069
3.5 in.	R-13.3	U-0.082	U-0.080	U-0.077
3.5 in	R-17.5	U-0.069	U-0.067	U-0.065
3.5 in.	R-19.6	U-0.064	U-0.062	U-0.061

(continued)

TABLE B-9 - continued
ASSEMBLY *U*-FACTORS FOR ABOVE-GRADE CONCRETE WALLS AND MASONRY WALLS

Framing Type and Depth	Rated *R*-Value of Insulation Alone	Assembly *U*-Factors for 8 in. Normal Weight 145 lb/ft^3 Solid Concrete Walls	Assembly *U*-Factors for 8 in., Medium Weight 115 lb/ft^3 Concrete Block Walls: Solid Grouted	Assembly *U*-Factors for 8 in. Medium Weight 115 lb/ft^3 Concrete Block Walls: Partially Grouted (cores uninsulated except where specified)
No Framing	R-0	U-0.740	U-0.580	U-0.480
	Ungrouted Cores Filled with Loose-fill insulation	N.A.	N.A.	U-0.350
1 in. metal clips at 24 in. on center horizontally and 16 in. vertically				
4.0 in	R-15.2	U-0.073	U-0.071	U-0.070
4.0 in.	R-20.0	U-0.061	U-0.060	U-0.058
4.0 in.	R-22.4	U-0.057	U-0.056	U-0.054
5.0 in	R-28.0	U-0.046	U-0.046	U-0.045
6.0 in.	R-33.6	U-0.039	U-0.039	U-0.038
7.0 in.	R-39.2	U-0.034	U-0.034	U-0.033
8.0 in.	R-44.8	U-0.030	U-0.030	U-0.029
9.0 in.	R-50.4	U-0.027	U-0.027	U-0.026
10.0 in.	R-56.0	U-0.024	U-0.024	U-0.024
11.0 in.	R-61.6	U-0.022	U-0.022	U-0.022
Continuous insulation uninterrupted by framing				
No Framing	R-1.0	U-0.425	U-0.367	U-0.324
No Framing	R-2.0	U-0.298	U-0.269	U-0.245
No Framing	R-3.0	U-0.230	U-0.212	U-0.197
No Framing	R-4.0	U-0.187	U-0.175	U-0.164
No Framing	R-5.0	U-0.157	U-0.149	U-0.141
No Framing	R-6.0	U-0.136	U-0.129	U-0.124
No Framing	R-7.0	U-0.120	U-0.115	U-0.110
No Framing	R-8.0	U-0.107	U-0.103	U-0.099
No Framing	R-9.0	U-0.097	U-0.093	U-0.090
No Framing	R-10.0	U-0.088	U-0.085	U-0.083
No Framing	R-11.0	U-0.081	U-0.079	U-0.076
No Framing	R-12.0	U-0.075	U-0.073	U-0.071
No Framing	R-13.0	U-0.070	U-0.068	U-0.066
No Framing	R-14.0	U-0.065	U-0.064	U-0.062
No Framing	R-15.0	U-0.061	U-0.060	U-0.059
No Framing	R-16.0	U-0.058	U-0.056	U-0.055
No Framing	R-17.0	U-0.054	U-0.053	U-0.052
No Framing	R-18.0	U-0.052	U-0.051	U-0.050
No Framing	R-19.0	U-0.049	U-0.048	U-0.047
No Framing	R-20.0	U-0.047	U-0.046	U-0.045
No Framing	R-21.0	U-0.045	U-0.044	U-0.043
No Framing	R-22.0	U-0.043	U-0.042	U-0.042
No Framing	R-23.0	U-0.041	U-0.040	U-0.040
No Framing	R-24.0	U-0.039	U-0.039	U-0.038
No Framing	R-25.0	U-0.038	U-0.037	U-0.037
No Framing	R-30.0	U-0.032	U-0.032	U-0.031
No Framing	R-35.0	U-0.028	U-0.027	U-0.027
No Framing	R-40.0	U-0.024	U-0.024	U-0.024
No Framing	R-45.0	U-0.022	U-0.021	U-0.021
No Framing	R-50.0	U-0.019	U-0.019	U-0.019
No Framing	R-55.0	U-0.018	U-0.018	U-0.018
No Framing	R-60.0	U-0.016	U-0.016	U-0.016

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m^3

TABLE B-10
ASSEMBLY *U*-FACTORS, C-FACTORS, R_u, R_c, AND HEAT CAPACITY FOR CONCRETE

Density in lb/ft³	Properties	Thickness in Inches									
		3	4	5	6	7	8	9	10	11	12
20	*U*-factor	0.22	0.17	0.14	0.12	0.10	0.09	0.08	0.07	0.07	0.06
	C-factor	0.27	0.20	0.16	0.13	0.11	0.10	0.09	0.08	0.07	0.07
	R_u	4.60	5.85	7.10	8.35	9.60	10.85	12.10	13.35	14.60	15.85
	R_c	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50	13.75	15.00
	HC	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	3.7	4.0
30	*U*-factor	0.28	0.22	0.19	0.16	0.14	0.12	0.11	0.10	0.09	0.09
	C-factor	0.37	0.28	0.22	0.18	0.16	0.14	0.12	0.11	0.10	0.09
	R_u	3.58	4.49	5.40	6.30	7.21	8.12	9.03	9.94	10.85	11.76
	R_c	2.73	3.64	4.55	5.45	6.36	7.27	8.18	9.09	10.00	10.91
	HC	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
40	*U*-factor	0.33	0.27	0.23	0.19	0.17	0.15	0.14	0.13	0.11	0.11
	C-factor	0.47	0.35	0.28	0.23	0.20	0.18	0.16	0.14	0.13	0.12
	R_u	2.99	3.71	4.42	5.14	5.85	6.56	7.28	7.99	8.71	9.42
	R_c	2.14	2.86	3.57	4.29	5.00	5.71	6.43	7.14	7.86	8.57
	HC	2.0	2.7	3.3	4.0	4.7	5.3	6.0	6.7	7.3	8.0
50	*U*-factor	0.38	0.31	0.26	0.23	0.20	0.18	0.16	0.15	0.14	0.13
	C-factor	0.57	0.43	0.34	0.28	0.24	0.21	0.19	0.17	0.15	0.14
	R_u	2.61	3.2	3.79	4.38	4.97	5.56	6.14	6.73	7.32	7.91
	R_c	1.76	2.35	2.94	3.53	4.12	4.71	5.29	5.88	6.47	7.06
	HC	2.5	3.3	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0
85	*U*-factor	0.65	0.56	0.50	0.44	0.40	0.37	0.34	0.31	0.29	0.27
	C-factor	1.43	1.08	0.86	0.71	0.61	0.54	0.48	0.43	0.39	0.36
	R_u	1.55	1.78	2.01	2.25	2.48	2.71	2.94	3.18	3.41	3.64
	R_c	0.70	0.93	1.16	1.40	1.63	1.86	2.09	2.33	2.56	2.79
	HC	4.3	5.7	7.1	8.5	9.9	11.3	12.8	14.2	15.6	17.0
95	*U*-factor	0.72	0.64	0.57	0.52	0.48	0.44	0.41	0.38	0.36	0.33
	C-factor	1.85	1.41	1.12	0.93	0.80	0.70	0.62	0.56	0.51	0.47
	R_u	1.39	1.56	1.74	1.92	2.10	2.28	2.46	2.64	2.81	2.99
	R_c	0.54	0.71	0.89	1.07	1.25	1.43	1.61	1.79	1.96	2.14
	HC	4.8	6.3	7.9	9.5	11.1	12.7	14.3	15.8	17.4	19.0
105	*U*-factor	0.79	0.71	0.65	0.59	0.54	0.51	0.47	0.44	0.42	0.39
	C-factor	2.38	1.79	1.43	1.18	1.01	0.88	0.79	0.71	0.65	0.59
	R_u	1.27	1.41	1.56	1.70	1.84	1.98	2.12	2.26	2.40	2.54
	R_c	0.42	0.56	0.70	0.85	0.99	1.13	1.27	1.41	1.55	1.69
	HC	5.3	7.0	8.8	10.5	12.3	14.0	15.8	17.5	19.3	21.0
115	*U*-factor	0.84	0.77	0.70	0.65	0.61	0.57	0.53	0.50	0.48	0.45
	C-factor	2.94	2.22	1.75	1.47	1.25	1.10	0.98	0.88	0.80	0.74
	R_u	1.19	1.30	1.42	1.53	1.65	1.76	1.87	1.99	2.10	2.21
	R_c	0.34	0.45	0.57	0.68	0.80	0.91	1.02	1.14	1.25	1.36
	HC	5.8	7.7	9.6	11.5	13.4	15.3	17.3	19.2	21.1	23.0

(continued)

TABLE B-10 - continued
ASSEMBLY *U*-FACTORS, C-FACTORS, R_u, R_c, and HEAT CAPACITY FOR CONCRETE

125	*U*-factor	0.88	0.82	0.76	0.71	0.67	0.63	0.60	0.56	0.53	0.51
	C-factor	3.57	2.70	2.17	1.79	1.54	1.35	1.20	1.08	0.98	0.90
	R_u	1.13	1.22	1.31	1.41	1.50	1.59	1.68	1.78	1.87	1.96
	R_c	0.28	0.37	0.46	0.56	0.65	0.74	0.83	0.93	1.02	1.11
	HC	6.3	8.3	10.4	12.5	14.6	16.7	18.8	20.8	22.9	25.0
135	*U*-factor	0.93	0.87	0.82	0.77	0.73	0.69	0.66	0.63	0.60	0.57
	C-factor	4.55	3.33	2.70	2.22	1.92	1.67	1.49	1.33	1.22	1.11
	R_u	1.07	1.15	1.22	1.30	1.37	1.45	.52	1.60	1.67	1.75
	R_c	0.22	0.30	0.37	0.45	0.52	0.60	0.67	0.75	0.82	0.90
	HC	6.8	9.0	11.3	13.5	15.8	18.0	20.3	22.5	24.8	27.0
144	*U*-factor	0.96	0.91	0.86	0.81	0.78	0.74	0.71	0.68	0.65	0.63
	C-factor	5.26	4.00	3.23	2.63	2.27	2.00	1.79	1.59	1.45	1.33
	R_u	1.04	1.10	1.16	1.23	1.29	1.35	1.41	1.48	1.54	1.60
	R_c	0.19	0.25	0.31	0.38	0.44	0.50	0.56	0.63	0.69	0.75
	HC	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0	26.4	28.8

For SI: 1 inch = 25.4 mm, 1 pound per cubic feet = 16.02 kg/m^3.

The *U*-factors and R_u include standard air film resistances.

The C-factors and R_c are for the same assembly without air film resistances.

Note that the following assemblies do not qualify as a mass wall or mass floor: 3-inch-thick concrete with densities of 85, 95, 125 and 135 lbs/ft^3.

1. For concrete walls, determine the *U*-factor from Table B-10 based on the concrete density and wall thickness.
2. For concrete block walls, determine the *U*-factor from Table B-11 based on the block size, concrete density, degree of grouting in the cells, and whether the cells are insulated.

b. If the mass wall has additional insulation:
1. For concrete walls, determine the *Ru* from Table B-10 based on the concrete density and wall thickness. Next, determine the effective *R*-value for the insulation/ framing layer from Table B-12 based on the rated *R*-value of insulation installed, the thickness of the insulation, and whether it is installed between wood or metal framing or with no framing. Then, determine the *U*-factor by adding the *Ru* and the effective *R*-value together and taking the inverse of the total.
2. For concrete block walls, determine the *Ru* from Table B-11 based on the block size, concrete density, degree of grouting in the cells, and whether the cells are insulated. Next, determine the effective *R*-value for the insulation/framing layer from Table B-12 based on the rated *R*-value of insulation installed, the thickness of the insulation, and whether it is installed between wood or metal framing or with no framing. Then, determine the *U*-factor by adding the *Ru* and the effective *R*-value together and taking the inverse of the total.

B2.2.1.2 Metal building walls.

B2.2.1.2.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a wall where the insulation is compressed between metal wall panels and the metal structure. Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing.

B2.2.1.2.2 Rated *R*-value of insulation for metal building walls.

B2.2.1.2.2.1 The first *rated R-value of insulation* is for insulation compressed between metal wall panels and the steel structure.

B2.2.1.2.2.2 For double-layer installations, the second *rated R-value of insulation* is for insulation installed from the inside, covering the girts.

B2.2.1.2.2.3 For continuous insulation (e.g., insulation boards) it is assumed that the insulation boards are installed on the inside of the girts and uninterrupted by the framing members.

TABLE B-11
ASSEMBLY *U*-FACTORS, C-FACTORS, R_U, R_C, AND HEAT CAPACITY FOR CONCRETE BLOCK WALLS

Density lb./ft.^{3}	Properties	Concrete Block Grouting and Cell Treatment				
		Solid grouted	Partly Grouted, Cells Empty	Partly Grouted, Cells Insulated	Unreinforced, Cells Empty	Unreinforced, Cells Insulated
6 in. block						
85	*U*-factor	0.57	0.46	0.34	0.4	0.2
	C-factor	1.11	0.75	0.47	0.6	0.23
	R_u	1.75	2.18	2.97	2.52	5.13
	R_c	0.90	1.33	2.12	1.67	4.28
	HC	10.9	6.7	7	4.2	4.6
95	*U*-factor	0.61	0.49	0.36	0.42	0.22
	C-factor	1.25	0.83	0.53	0.65	0.27
	R_u	1.65	2.06	2.75	2.38	4.61
	R_c	0.80	1.21	1.90	1.53	3.76
	HC	11.4	7.2	7.5	4.7	5.1
105	*U*-factor	0.64	0.51	0.39	0.44	0.24
	C-factor	1.38	0.91	0.58	0.71	0.3
	R_u	1.57	1.95	2.56	2.26	4.17
	R_c	0.72	1.1	1.71	1.41	3.32
	HC	11.9	7.7	7.9	5.1	5.6
115	*U*-factor	0.66	0.54	0.41	0.46	0.26
	C-factor	1.52	0.98	0.64	0.76	0.34
	R_u	1.51	1.87	2.41	2.16	3.79
	R_c	0.66	1.02	1.56	1.31	2.94
	HC	12.3	8.1	8.4	5.6	6
125	*U*-factor	0.70	0.56	0.45	0.49	0.30
	C-factor	1.70	1.08	0.73	0.84	0.4
	R_u	1.44	1.78	2.23	2.04	3.38
	R_c	0.59	0.93	1.38	1.19	2.53
	HC	12.8	8.6	8.8	6.0	6.5
135	*U*-factor	0.73	0.6	0.49	0.53	0.35
	C-factor	1.94	1.23	0.85	0.95	0.49
	R_u	1.36	1.67	2.02	1.9	2.89
	R_c	0.51	0.82	1.17	1.05	2.04
	HC	13.2	9	9.3	6.5	6.9
8 in. block						
85	*U*-factor	0.49	0.41	0.28	0.37	0.15
	C-factor	0.85	0.63	0.37	0.53	0.17
	R_u	2.03	2.43	3.55	2.72	6.62
	R_c	1.18	1.58	2.7	1.87	5.77
	HC	15	9	9.4	5.4	6
95	*U*-factor	0.53	0.44	0.31	0.39	0.17
	C-factor	0.95	0.7	0.41	0.58	0.2
	R_u	1.9	2.29	3.27	2.57	5.92
	R_c	1.05	1.44	2.42	1.72	5.07
	HC	15.5	9.6	10	6	6.6

(continued)

TABLE B-11 - continued
ASSEMBLY *U*-FACTORS, C-FACTORS, R_U, R_C, AND HEAT CAPACITY FOR CONCRETE BLOCK WALLS

8 in. block (continued)						
105	*U*-factor	0.55	0.46	0.33	0.41	0.19
	C-factor	1.05	0.76	0.46	0.63	0.22
	R_u	1.81	2.17	3.04	2.44	5.32
	R_c	0.96	1.32	2.19	1.59	4.47
	HC	16.1	10.2	10.6	6.6	7.2
115	*U*-factor	0.58	0.48	0.35	0.43	0.21
	C-factor	1.14	0.82	0.5	0.68	0.25
	R_u	1.72	2.07	2.84	2.33	4.78
	R_c	0.87	1.22	1.99	1.48	3.93
	HC	16.7	10.8	11.2	7.2	7.8
125	*U*-factor	0.61	0.51	0.38	0.45	0.24
	C-factor	1.27	0.9	0.57	0.74	0.3
	R_u	1.64	1.96	2.62	2.2	4.2
	R_c	0.79	1.11	1.77	1.35	3.35
	HC	17.3	11.4	11.8	7.8	8.4
135	*U*-factor	0.65	0.55	0.42	0.49	0.28
	C-factor	1.44	1.02	0.67	0.83	0.37
	R_u	1.54	1.83	2.35	2.05	3.55
	R_c	0.69	0.98	1.50	1.2	2.70
	HC	17.9	12.0	12.4	8.4	9.0
10 in. block						
85	*U*-factor	0.44	0.38	0.25	0.35	0.13
	C-factor	0.70	0.57	0.31	0.50	0.14
	R_u	2.29	2.61	4.05	2.84	7.87
	R_c	1.44	1.76	3.20	1.99	7.02
	HC	19.0	11.2	11.7	6.50	7.30
95	*U*-factor	0.47	0.41	0.27	0.37	0.14
	C-factor	0.77	0.62	0.35	0.55	0.16
	R_u	2.15	2.46	3.73	2.67	6.94
	R_c	1.30	1.61	2.88	1.82	6.09
	HC	19.7	11.9	12.4	7.3	8.10
105	*U*-factor	0.49	0.43	0.29	0.39	0.16
	C-factor	0.85	0.68	0.39	0.59	0.19
	R_u	2.03	2.33	3.45	2.54	6.17
	R_c	1.18	1.48	2.60	1.69	5.32
	HC	20.4	12.6	13.1	8.00	8.80
115	*U*-factor	0.52	0.45	0.31	0.41	0.18
	C-factor	0.92	0.73	0.42	0.64	0.21
	R_u	1.94	2.22	3.21	2.42	5.52
	R_c	1.09	1.37	2.36	1.57	4.67
	HC	21.1	13.4	13.9	8.70	9.50
125	*U*-factor	0.54	0.48	0.34	0.44	0.21
	C-factor	1.01	0.80	0.48	0.70	0.25
	R_u	1.84	2.10	2.95	2.28	4.81
	R_c	0.99	1.25	2.10	1.43	3.96
	HC	21.8	14.1	14.6	9.40	10.2

(continued)

TABLE B-11 - continued
ASSEMBLY *U*-FACTORS, C-FACTORS, R_U, R_C, AND HEAT CAPACITY FOR CONCRETE BLOCK WALLS

10 in. block (continued)						
135	*U*-factor	0.58	0.51	0.38	0.47	0.25
	C-factor	1.14	0.90	0.56	0.79	0.32
	R_u	1.72	1.96	2.64	2.12	4.00
	R_c	0.87	1.11	1.79	1.27	3.15
	HC	22.6	14.8	15.3	10.2	11.0
12 in. block						
85	*U*-factor	0.40	0.36	0.22	0.34	0.11
	C-factor	0.59	0.52	0.27	0.48	0.12
	R_u	2.53	2.77	4.59	2.93	9.43
	R_c	1.68	1.92	3.74	2.08	8.58
	HC	23.1	13.3	14.0	7.50	8.50
95	*U*-factor	0.42	0.38	0.24	0.36	0.12
	C-factor	0.66	0.57	0.30	0.52	0.13
	R_u	2.30	2.60	4.22	2.76	8.33
	R_c	1.53	1.75	3.37	1.91	7.48
	HC	23.9	14.2	14.8	8.30	9.30
105	*U*-factor	0.44	0.41	0.26	0.38	0.14
	C-factor	0.71	0.62	0.33	0.57	0.15
	R_u	2.25	2.47	3.90	2.62	7.35
	R_c	1.40	1.62	3.05	1.77	6.50
	HC	24.7	15.0	15.6	9.10	10.2
115	*U*-factor	0.47	0.42	0.28	0.40	0.15
	C-factor	0.77	0.66	0.36	0.61	0.18
	R_u	2.15	2.36	3.63	2.49	6.54
	R_c	1.30	1.51	2.78	1.64	5.69
	HC	25.6	15.8	16.4	10.0	11.0
125	*U*-factor	0.49	0.45	0.30	0.42	0.18
	C-factor	0.84	0.72	0.40	0.66	0.21
	R_u	2.04	2.23	3.34	2.36	5.68
	R_c	1.19	1.38	2.49	1.51	4.83
	HC	26.4	16.6	17.3	10.8	11.8
135	*U*-factor	0.52	0.48	0.34	0.46	0.21
	C-factor	0.94	0.81	0.47	0.74	0.26
	R_u	1.91	2.08	2.98	2.19	4.67
	R_c	1.06	1.23	2.13	1.34	3.82
	HC	27.2	17.5	18.1	11.60	12.6

For SI: 1 inch = 25.4 mm.

TABLE B-12
EFFECTIVE *R*-VALUES FOR INSULATION/FRAMING LAYERS ADDED TO ABOVE-GRADE MASS WALLS AND BELOW-GRADE WALLS

Depth (in.)	Framing Type	Rated *R*-Value of Insulation																								
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
		Effective R-value if continuous insulation uninterrupted by framing (includes gypsun board)																									
	None	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5
		Effective R-value if insulation is installed in cavity between framing (includes gypsum board)																									
0.5	Wood	1.3	1.3	1.9	2.4	2.7	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	0.9	0.9	1.1	1.1	1.2	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
0.75	Wood	1.4	1.4	2.1	2.7	3.1	3.5	3.8	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.0	1	1.3	1.4	1.5	1.5	1.6	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
1	Wood	1.3	1.5	2.2	2.9	3.4	3.9	4.3	4.6	4.9	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.0	1.1	1.4	1.6	1.7	1.8	1.8	1.9	1.9	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
1.5	Wood	1.3	1.5	2.4	3.1	3.8	4.4	4.9	5.4	5.8	6.2	6.5	6.8	7.1	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.1	1.2	1.6	1.9	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.6	2.7	na	na	na	na	na	na	na	na	na	na	na	na	na
2	Wood	1.4	1.5	2.5	3.3	4.0	4.7	5.3	5.9	6.4	6.9	7.3	7.7	8.1	8.4	8.7	9.0	9.3	na	na	na	na	na	na	na	na	na
	Metal	1.1	1.2	1.7	2.1	2.3	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.3	3.4	3.4	na	na	na	na	na	na	na	na	na
2.5	Wood	1.4	1.5	2.5	3.4	4.2	4.9	5.6	6.3	6.8	7.4	7.9	8.4	8.8	9.2	9.6	10.0	10.3	10.6	10.9	11.2	11.5	na	na	na	na	na
	Metal	1.2	1.3	1.8	2.3	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.6	3.7	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.1	na	na	na	na	na
3	Wood	1.4	1.5	2.5	3.5	4.3	5.1	5.8	6.5	7.2	7.8	8.3	8.9	9.4	9.9	10.3	10.7	11.1	11.5	11.9	12.2	12.5	12.9	na	na	na	na
	Metal	1.2	1.3	1.9	2.4	2.8	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8	na	na	na	na
3.5	Wood	1.4	1.5	2.6	3.5	4.4	5.2	6.0	6.7	7.4	8.1	8.7	9.3	9.8	10.4	10.9	11.3	11.8	12.2	12.6	13	13.4	13.8	14.1	14.5	14.8	15.1
	Metal	1.2	1.3	2.0	2.5	2.9	3.2	3.5	3.8	4.0	4.2	4.3	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.1	5.2	5.2	5.3	5.4	5.4	5.4	5.5
4	Wood	1.4	1.6	2.6	3.6	4.5	5.3	6.1	6.9	7.6	8.3	9.0	9.6	10.2	10.8	11.3	11.9	12.4	12.8	13.3	13.7	14.2	14.6	14.9	15.3	15.7	16
	Metal	1.2	1.3	2.0	2.6	3.0	3.4	3.7	4.0	4.2	4.5	4.6	4.8	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.8	5.9	5.9	6.0	6.0
4.5	Wood	1.4	1.6	2.6	3.6	4.5	5.4	6.2	7.1	7.8	8.5	9.2	9.9	10.5	11.2	11.7	12.3	12.8	13.3	13.8	14.3	14.8	15.2	15.7	16.1	16.5	16.9
	Metal	1.2	1.3	2.1	2.6	3.1	3.5	3.9	4.2	4.5	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.4	6.5	6.6
5	Wood	1.4	1.6	2.6	3.6	4.6	5.5	6.3	7.2	8.0	8.7	9.4	10.1	10.8	11.5	12.1	12.7	13.2	13.8	14.3	14.8	15.3	15.8	16.3	16.7	17.2	17.6
	Metal	1.2	1.4	2.1	2.7	3.2	3.7	4.1	4.4	4.7	5.0	5.2	5.4	5.6	5.8	5.9	6.1	6.2	6.3	6.5	6.6	6.7	6.8	6.8	6.9	7.0	7.1
5.5	Wood	1.4	1.6	2.6	3.6	4.6	5.5	6.4	7.3	8.1	8.9	9.6	10.3	11.0	11.7	12.4	13	13.6	14.2	14.7	15.3	15.8	16.3	16.8	17.3	17.8	18.2
	Metal	1.3	1.4	2.1	2.8	3.3	3.8	4.2	4.6	4.9	5.2	5.4	5.7	5.9	6.1	6.3	6.4	6.6	6.7	6.8	7.0	7.1	7.2	7.3	7.4	7.5	7.6

For SI: 1 inch = 25.4 mm.

TABLE B-13
ASSEMBLY *U*-FACTORS FOR METAL BUILDING WALLS

Insulation System	Rated *R*-Value of Insulation	Total Rated *R*-Value of Insulation	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation					
				R-5.6	R-11.2	R-16.8	R-22.4	R-28.0	R-33.6
Single Layer of Mineral Fiber	None	0	1.180	0.161	0.086	0.059	0.045	0.036	0.030
	R-6	6	0.184	0.091	0.060	0.045	0.036	0.030	0.026
	R-10	10	0.134	0.077	0.054	0.041	0.033	0.028	0.024
	R-11	11	0.123	0.073	0.052	0.040	0.033	0.028	0.024
	R-13	13	0.113	0.069	0.050	0.039	0.032	0.027	0.024
Double Layer of Mineral Fiber (Second layer inside of girts) (Multiple layers are listed in order from inside to outside)	R-6 + R-13	19	0.070	Na	na	na	na	na	na
	R-10 + R-13	23	0.061	Na	na	na	na	na	na
	R-13 + R-13	26	0.057	Na	na	na	na	na	na
	R-19 + R-13	32	0.048	Na	na	na	na	na	na

TABLE B-14
ASSEMBLY *U*-FACTORS FOR STEEL FRAME WALLS

Framing Type and Spacing Width (actual depth)	Cavity Insulation *R*-Value: Rated/ (effective installed [see Table B-17])	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing), Rated *R*-Value of Continuous Insulation																		
			R-1.0	R-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Steel Framing at 16 in. OC																					
(3.5 in. depth)	None(0.0)	0.352	0.260	0.207	0.171	0.146	0.128	0.113	0.102	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.03	0.026	0.023
	R-11(5.5)	0.132	0.117	0.105	0.095	0.087	0.08	0.074	0.069	0.064	0.06	0.057	0.054	0.051	0.049	0.046	0.044	0.036	0.031	0.027	0.024	0.021
	R-13(6.0)	0.124	0.111	0.10	0.091	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.052	0.050	0.048	0.045	0.043	0.036	0.030	0.026	0.023	0.021
	R-15(6.4)	0.118	0.106	0.096	0.087	0.08	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045	0.043	0.035	0.030	0.026	0.023	0.021
(6.0 in. depth)	R-19(7.1)	0.109	0.099	0.090	0.082	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.034	0.029	0.026	0.023	0.020
	R-21(7.4)	0.106	0.096	0.087	0.08	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045	0.043	0.041	0.034	0.029	0.025	0.022	0.020
Steel Framing at 24 in. OC																					
(3.5 in. depth)	None(0.0)	0.338	0.253	0.202	0.168	0.144	0.126	0.112	0.1	0.091	0.084	0.077	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.03	0.026	0.023
	R-11(6.6)	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.021
	R-13(7.2)	0.108	0.098	0.089	0.082	0.075	0.07	0.066	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.034	0.029	0.025	0.023	0.020
	R-15(7.8)	0.102	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.05	0.048	0.046	0.044	0.042	0.040	0.034	0.029	0.025	0.022	0.020

B2.2.1.2.2.4 Insulation exposed to the *conditioned space* or *semiheated space* shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

B2.2.1.2.3 *U*-factors for metal building walls. *U*-factors for metal building walls shall be taken from Table B-13. It is not acceptable to use these *U*-factors if additional insulation is not continuous.

B2.2.1.3 Steel-framed walls.

B2.2.1.3.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a wall where the insulation is installed within the cavity of the steel stud framing but where there is not a metal exterior surface spanning member. The steel stud framing is a minimum uncoated thickness of 0.043 inches (1.1 mm) for 18 gauge or 0.054 inches for 16 gauge. The *U*-factor includes R-0.17 for exterior air film, R-0.08 for stucco, R-0.56 for 0.625-inches (16 mm) gypsum board on the exterior, R-0.56 for 0.625-inches (16 mm) gypsum board on the interior, and R-0.68 for interior vertical surfaces air film. The performance of the insulation/framing layer is calculated using the values in Table B-17. Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing. *U*-factors are provided for the following configurations:

a. Standard framing: steel stud framing at 16 inches (410 mm) on center with cavities filled with 16 inch (410 mm) wide insulation for both $3^1/_2$-inch (89 mm) deep and 6-inch (152 mm) deep wall cavities.

b. Advanced framing: steel stud framing at 24 inches (610 mm) on center with cavities filled with 24 inch (610 mm) wide insulation for both $3^1/_2$-inch (89 mm) deep and 6-inch (152 mm) deep wall cavities.

B2.2.1.3.2 Rated *R*-value of insulation for steel-framed walls.

B2.2.1.3.2.1 The first rated *R*-value of insulation is for uncompressed insulation installed in the cavity between steel studs. It is acceptable for this insulation to also be continuous insulation uninterrupted by framing.

B2.2.1.3.2.2 If there are two values, the second rated *R*-value of insulation is for continuous insulation uninterrupted by framing, etc., to be installed in addition to the first insulation.

B2.2.1.3.2.3 Opaque mullions in spandrel glass shall be covered with insulation complying with the steel-framed wall requirements.

B2.2.1.3.3 *U*-factors for steel-framed walls.

B2.2.1.3.3.1 *U-factors* for *steel-framed walls* shall be taken from Table B-14.

B2.2.1.3.3.2 For *steel-framed walls* with framing at less than 24 inches (610 mm) on center, use the standard framing values as described in Section B2.2.1.3.1(a).

B2.2.1.3.3.3 For *steel-framed walls* with framing from 24 inches to 32 inches (610 mm to 813 mm) on center, use the advanced framing values as described in B2.2.1.3.1(b).

B2.2.1.3.3.4 For *steel-framed walls* with framing greater than 32 inches (813 mm) on center, use the *metal building wall* values in Table B-13.

B2.2.1.4 Wood-framed walls.

B2.2.1.4.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a wall where the insulation is installed between 2 inches (51 mm) nominal wood framing. Cavity insulation is full depth, but values are taken from Table B-3 for R-19 insulation, which is compressed when installed in a 5.5 inches (368 mm) cavity. Headers are double 2 inches (51 mm) nominal wood framing. The *U*-factor includes R-0.17 for exterior air film, R-0.08 for stucco, R-0.56 for 0.625 inches (16 mm) gypsum board on the exterior, R-0.56 for 0.625 inches (16 mm) gypsum board on the interior, and R-0.68 for interior air film, vertical surfaces. Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing. *U*-factors are provided for the following configurations:

a. Standard framing: Wood framing at 16 inches (410 mm) on center with cavities filled with $14^1/_2$ inches (368 mm) wide insulation for both $3^1/_2$-inch (89 mm) deep and $5^1/_2$ inches (140 mm) deep wall cavities. Double headers leave no cavity. Weighting factors are 75-percent insulated cavity, 21-percent studs, plates, and sills, and 4-percent headers.

b. Advanced framing: Wood framing at 24 inches (610 mm) on center with cavities filled with $22^1/_2$ inches (572 mm) wide insulation for both $3^1/_2$-inch (89 mm) deep and $5^1/_2$ inches (140 mm) deep wall cavities. Double headers leave uninsulated cavities. Weighting factors are 78-percent insulated cavity, 18-percent studs, plates, and sills, and 4-percent headers.

c. Advanced framing with insulated headers: wood framing at 24 inches (610 mm) on center with cavities filled with $22^1/_2$ inches wide (572 mm) insulation for both $3^1/_2$-inch (89 mm) deep and $5^1/_2$ inches (140 mm) deep wall cavities. Double header cavities are insulated. Weighting factors are 78-percent insulated cavity, 18-percent studs, plates, and sills, and 4-percent headers.

B2.2.1.4.2 Rated *R*-value of insulation for wood-framed and other walls.

B2.2.1.4.2.1 The first rated *R*-value of insulation is for uncompressed insulation installed in the cavity between wood studs. It is acceptable for this insu-

TABLE B-15
ASSEMBLY *U*-FACTORS FOR WOOD FRAME WALLS

Framing Type and Spacing Width (actual Depth)	Cavity Insulation *R*-Value: Rated/ [effective stalled (see Table B-3)]	Overall *U*-Factor for Entire Base Wall	Overall *U*-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation																			
			R-1.0	E-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Wood Studs at 16 in. OC																						
(3.5 in. depth)	None(0.0)	0.292	0.223	0.181	0.152	0.132	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.056	0.053	0.042	0.035	0.030	0.026	0.023
	R-11(11.0)	0.096	0.087	0.079	0.073	0.068	0.063	0.059	0.056	0.053	0.05	0.048	0.046	0.044	0.042	0.040	0.038	0.032	0.028	0.024	0.022	0.020
	R-13(13.0)	0.089	0.080	0.074	0.068	0.063	0.059	0.056	0.053	0.05	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.031	0.027	0.024	0.021	0.019
	R-15(15.0)	0.083	0.075	0.069	0.064	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023	0.020	0.019
(5.5 in. depth)	R-19(18.0)	0.067	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.04	0.038	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021	0.019	0.018
	R-21(21.0)	0.063	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.031	0.030	0.026	0.023	0.021	0.019	0.017
(+R-10 headers)	R-19(18.0)	0.063	0.059	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.031	0.027	0.024	0.021	0.019	0.017
	R-21(21.0)	0.059	0.055	0.051	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020	0.018	0.017
Wood Studs at 24 in.OC																						
(3.5 in. depth)	None(0.0)	0.298	0.227	0.183	0.154	0.133	0.117	0.105	0.095	0.086	0.079	0.074	0.068	0.064	0.060	0.057	0.054	0.042	0.035	0.030	0.026	0.023
	R-11(11.0)	0.094	0.085	0.078	0.072	0.067	0.062	0.059	0.055	0.052	0.05	0.047	0.045	0.043	0.041	0.040	0.038	0.032	0.027	0.024	0.022	0.019
	R-13(13.0)	0.086	0.078	0.072	0.067	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.031	0.026	0.023	0.021	0.019
	R-15(15.0)	0.080	0.073	0.067	0.062	0.058	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.029	0.026	0.023	0.020	0.018
(5.5 in. depth)	R-19(18.0)	0.065	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.027	0.024	0.021	0.019	0.018
	R-21(21.0)	0.060	0.056	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.02	0.018	0.017
(+ R-10 headers)	R-19(18.0)	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.027	0.024	0.021	0.019	0.017
	R-21(21.0)	0.057	0.053	0.05	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.025	0.023	0.020	0.018	0.017

For SI: 1 inch = 25.4 mm.

TABLE B-16
ASSEMBLY C-FACTORS FOR BELOW-GRADE WALLS

Framing Type & Depth	Rated *R*-Value of Insulation Alone	Specified C-Factors (wall only, without soil & air films)
No Framing	R-0	C-1.140
Exterior Insulation continuous and uninterrupted by framing		
No Framing	5.0	0.170
No Framing	7.5	0.119
No Framing	10.0	0.092
No Framing	12.5	0.075
No Framing	15.0	0.063
No Framing	17.5	0.054
No Framing	20.0	0.048
No Framing	25.0	0.039
No Framing	30.0	0.032
No Framing	35.0	0.028
No Framing	40.0	0.025
No Framing	45.0	0.022
No Framing	50.0	0.020
Continuous Framing at 24 in. OC horizontally		
3.5 in	11.0	0.182
3.5 in	13.0	0.174
3.5 in	15.0	0.168
5.5 in	19.0	0.125
5.5 in	21.0	0.120
1 in metal clips at 24 in. OC horizontally & 16 in. vertically		
1 in	3.8	0.233
1 in	5.0	0.201
1 in	5.6	0.189
1.5 in	5.7	0.173
1.5 in	7.5	0.147
1.5 in	8.4	0.138
2 in	7.6	0.138
2 in	10.0	0.116
2 in	11.2	0.108
2.5 in	9.5	0.114
2.5 in	12.5	0.096
2.5 in	14.0	0.089
3 in	11.4	0.098
3 in	15.0	0.082
3 in	16.8	0.076
3.5 in	13.3	0.085
3.5 in	17.5	0.071
3.5 in	19.6	0.066
4 in	15.2	0.076
4 in	20.0	0.063
4 in	22.4	0.058

For SI: 1 inch = 25.4 mm.

TABLE B-17
EFFECTIVE INSULATION/FRAMING LAYER R-VALUES FOR WALL INSULATION INSTALLED BETWEEN STEEL FRAMING

Nominal Depth of Cavity (in.)	Actual Depth of Cavity (in.)	Rated *R*-Value of Airspace or Insulation	Effective Framing/ Cavity *R*-Value at 16 in. on center	Effective Framing/Cavity at 24 in. on center
Empty cavity, no insulation				
4	3.5	R-0.91	0.79	0.91
Insulated Cavity				
4	3.5	R-11	5.5	6.6
4	3.5	R-13	6.0	7.2
4	3.5	R-15	6.4	7.8
6	6.0	R-19	7.1	8.6
6	6.0	R-21	7.4	9.0
8	8.0	R-25	7.8	9.6

For SI: 1 inch = 25.4 mm.

lation to also be continuous insulation uninterrupted by framing.

B2.2.1.4.2.2 If there are two values, the second rated *R*-value of insulation is for continuous insulation uninterrupted by framing, etc., to be installed in addition to the first insulation.

B2.2.1.4.2.3 Opaque mullions in spandrel glass shall be covered with insulation complying with the steel-framed wall requirements.

B2.2.1.4.3 *U*-factors for wood-framed walls.

B2.2.1.4.3.1 *U-factors for wood-framed walls* shall be taken from Table B-15.

B2.2.1.4.3.2 For *wood-framed walls* with framing at less than 24 inches (610 mm) on center, use the standard framing values as described in Section B2.2.1.4.1(a).

B2.2.1.4.3.3 For *wood-framed walls* with framing from 24 inches to 32 inches (610 mm to 813 mm) on center, use the advanced framing values as described in Section B2.2.1.4.1(b) if the headers are uninsulated or the advanced framing with insulated headers values as described in Section B2.2.1.4.1(c) if the headers are insulated.

B2.2.1.4.3.4 For *wood-framed walls* with framing greater than 32 inches (813 mm) on center, *U*-factors shall be determined in accordance with Section B1.5.

B2.2.2 Below-grade walls.

B2.2.2.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is 8 inches (203 mm) medium-weight concrete block with a density of 115 pound per cubic foot (1843 kg/m^3)and solid grouted cores. *Continuous insulation* is installed on the interior or exterior. In contrast to the *U*-factor for above-grade walls, the C-factor for below grade walls does not include *R*-values

for exterior or interior air films or for soil. For insulated walls, the C-factor does include R-0.45 for 0.5 inches gypsum board.

B2.2.2.2 C-factors for below grade walls.

B2.2.2.2.1 *C-factors for below grade walls* shall be taken from Table B-16 or determined by the procedure described in this subsection.

B2.2.2.2.2 It is acceptable to use the *C-factors* in Table B-16 for all *below grade walls.*

B2.2.2.2.3 If not taken from Table B-16, below-grade wall C-factors shall be determined from Tables B-10, B-11, and B-12 using the following procedure:

a. If the below-grade wall is uninsulated or only the cells are insulated:

(1) For concrete walls, determine the C-factor from Table B-10 based on the concrete density and wall thickness.

(2) For concrete block walls, determine the C-factor from Table B-11 based on the block size, concrete density, degree of grouting in the cells, and whether the cells are insulated.

b. If the mass wall has additional insulation:

(1) For concrete walls, determine the *Rc* from Table B-10 based on the concrete density and wall thickness. Next, determine the effective *R*-value for the insulation/framing layer from Table B-12 based on the rated *R*-value of insulation installed, the thickness of the insulation, and whether it is installed between wood or metal framing or with no framing. Then, determine the C-factor by adding the *Rc* and the effective *R*-value together and taking the inverse of the total.

TABLE B-18
EFFECTIVE INSULATION/FRAMING LAYER *R*-VALUES FOR ROOF AND FLOOR INSULATION INSTALLED BETWEEN METAL FRAMING (4 FT ON CENTER)

Rated *R*-Value of Insulation	Correction Factor	Framing/Cavity *R*-Value
0	1.00	0.00
4	0.97	3.88
5	0.96	4.80
8	0.94	7.52
10	0.92	9.20
11	0.91	10.01
12	0.9.0	10.80
13	0.9.0	11.70
15	0.88	13.20
16	0.87	13.92
19	0.86	16.34
20	0.85	17.00
21	0.84	17.64
24	0.82	19.68
25	0.81	20.25
30	0.79	23.70
35	0.76	26.60
38	0.74	28.12
40	0.73	29.20
45	0.71	31.95
50	0.69	34.50
55	0.67	36.85

For SI: 1 foot = 304.8 mm.

TABLE B-19
ASSEMBLY *U*-FACTORS FOR ROOFS WITH INSULATION ENTIRELY ABOVE DECK

Rated *R*-Value of Insulation Alone	Overall *U*-Factor for Entire Assembly
R-0	U-1.282
R-1	U-0.562
R-2	U-0.360
R-3	U-0.265
R-4	U-0.209
R-5	U-0.173
R-6	U-0.147
R-7	U-0.129
R-8	U-0.114
R-9	U-0.102
R-10	U-0.093
R-11	U-0.085
R-12	U-0.078
R-13	U-0.073
R-14	U-0.068
R-15	U-0.063
R-16	U-0.060
R-17	U-0.056
R-18	U-0.053
R-19	U-0.051
R-20	U-0.048
R-21	U-0.046
R-22	U-0.044
R-23	U-0.042
R-24	U-0.040
R-25	U-0.039
R-26	U-0.037
R-27	U-0.036
R-28	U-0.035
R-29	U-0.034
R-30	U-0.032
R-35	U- 0.028
R-40	U-0.025
R-45	U-0.020
R-50	U-0.020
R-55	U-0.018
R-60	U-0.016

(2) For concrete block walls, determine the *Rc* from Table B-10 based on the block size, concrete density, degree of grouting in the cells, and whether the cells are insulated. Next, determine the effective *R*-value for the insulation/framing layer from Table B-11 based on the rated *R*-value of insulation installed, the thickness of the insulation, and whether it is installed between wood or metal framing or with no framing. Then, determine the C-factor by adding the *Rc* and the effective *R*-value together and taking the inverse of the total.

B2.3 Opaque doors. All opaque doors with *U*-factors determined, certified, and labeled in accordance with NFRC 100 as specified in Section B1.1.3 shall be assigned those *U*-factors. Unlabeled opaque doors shall be assigned those *U*-factors.

B2.3.1 Unlabeled opaque doors. Unlabeled opaque doors shall be assigned the following *U*-factors.

a. Uninsulated single-layer metal swinging doors or nonswinging doors, including single-layer uninsulated access hatches and uninsulated smoke vents: 1.45

b. Uninsulated double-layer metal swinging doors or nonswinging doors, including double-layer uninsulated access hatches and uninsulated smoke vents: 0.70

c. Insulated metal swinging doors, including fire-rated doors, insulated access hatches, and insulated smoke vents: 0.50

d. Wood doors, minimum nominal thickness of $1^3/_4$ inches (44 mm), including panel doors with minimum panel thickness of $1^1/_8$ inches (29 mm), solid core flush doors, and hollow core flush doors: 0.50.

e. Any other wood door: 0.60.

B2.4 Roofs.

B2.4.1 General. The buffering effect of suspended ceilings or attic spaces shall not be included in *U*-factor calculations.

B2.4.2 Roofs with insulation entirely above deck.

B2.4.2.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is continuous insulation over a structural deck. The *U*-factor includes R-0.17 for exterior air film, R-0 for metal deck, and R-0.61 for interior air film heat flow up. Added insulation is continuous and uninterrupted by framing. The framing factor is zero.

B2.4.2.2 Rated *R*-value of insulation. For roofs with insulation entirely above deck, the rated *R*-value of insulation is for continuous insulation.

Exception: Interruptions for framing and pads for mechanical equipment are permitted with a combined total area not exceeding 1 percent of the total opaque assembly area.

B2.4.2.3 *U*-factor. *U*-factors for roofs with insulation entirely above deck shall be taken from Table B-19. It is not acceptable to use these *U*-factors if the insulation is not entirely above deck or not continuous.

B2.4.3 Metal building roofs.

B2.4.3.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a roof where the insulation is draped over the steel structure (purlins) and then compressed when the metal spanning members are attached to the steel structure (purlins). Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing.

B2.4.3.2 Rated *R*-value of insulation.

B2.4.3.2.1 The first rated *R*-value of insulation is for insulation draped over purlins and then compressed when the metal spanning members are attached, or for insulation hung between the purlins, provided there is a minimum 1 inch (25 mm) thermal break between the purlins and the metal spanning members.

B2.4.3.2.2 For double-layer installations, the second rated *R*-value of insulation is for insulation installed parallel to the purlins.

B2.4.3.2.3 For continuous insulation (e.g. insulation boards), it is assumed that the insulation boards are installed below the purlins and are uninterrupted by framing members. Insulation exposed to the conditioned space or semiheated space shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

B2.4.3.3 *U*-factor. *U*-factors for metal building roofs shall be taken from Table B-20. It is not acceptable to use these *U*-factors if additional insulated sheathing is not continuous.

B2.4.4 Attic roofs with wood joists.

B2.4.4.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base attic roof assembly is a roof with a nominal 4-inch (102 mm) deep wood as the lower chord of a roof truss or ceiling joist.

The ceiling is attached directly to the lower chord of the truss and the attic space above is ventilated. Insulation is located directly on top of the ceiling, first filling the cavities between the wood and then later covering both the wood and cavity areas. No credit is given for roofing materials. The single-rafter roof is similar to the base attic roof, with the key difference being that there is a single, deep rafter to which both the roof and the ceiling are attached. The heat flow path through the rafter is calculated to be the same depth as the insulation. The *U*-factor includes R-0.46 for semi-exterior air film, R-0.56 for 0.625 inch (16 mm) gypsum board, and R-0.61 for interior air film heat flow up. *U*-factors are provided for the following configurations:

a. Attic roof, standard framing: insulation is tapered around the perimeter with resultant decrease in thermal resistance. Weighting factors are 85-per-

TABLE B-20
ASSEMBLY *U*-FACTORS FOR METAL BUILDING ROOFS

Insulation System	Rated *R*-Value of Insulation	Total rated *R*-value of Insulation	Overall *U*-Factor for Entire Base Roof Assembly	Overall *U*-Factor for Assembly of Base Roof Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation					
				R-5.6	R-11.2	R-16.8	R-22.4	R-28.0	R-33.6
Standing Seam Roofs with Thermal Blocks									
Single Layer	None	0	1.280	0.162	0.087	0.059	0.045	0.036	0.030
	R-6	6	0.167	0.086	0.058	0.044	0.035	0.029	0.025
	R-10	10	0.097	0.063	0.046	0.037	0.031	0.026	0.023
	R-11	11	0.092	0.061	0.045	0.036	0.030	0.026	0.022
	R-13	13	0.083	0.057	0.043	0.035	0.029	0.025	0.022
	R-16	16	0.072	0.051	0.040	0.033	0.028	0.024	0.021
	R-19	19	0.065	0.048	0.038	0.031	0.026	0.023	0.020
Double Layer	R-10 + R-10	20	0.063	0.047	0.037	0.031	0.026	0.023	0.020
	R-10 + R-11	21	0.061	0.045	0.036	0.030	0.026	0.023	0.020
	R-11 + R-11	22	0.060	0.045	0.036	0.030	0.026	0.022	0.020
	R-10 + R-13	23	0.058	0.044	0.035	0.029	0.025	0.022	0.020
	R-11 + R-13	24	0.057	0.043	0.035	0.029	0.025	0.022	0.020
	R-13 + R-13	26	0.055	0.042	0.034	0.029	0.025	0.022	0.019
	R-10 + R-19	29	0.052	0.040	0.033	0.028	0.024	0.021	0.019
	R-11 + R-19	30	0.051	0.040	0.032	0.027	0.024	0.0021	0.019
	R-13 + R-19	32	0.049	0.038	0.032	0.027	0.023	0.021	0.019
	R-16 + R-19	35	0.047	0.037	0.031	0.026	0.023	0.020	0.018
	R-19 + R-19	38	0.046	0.037	0.030	0.026	0.023	0.020	0.018
(Multiple R-values are listed in order from inside to outside)									
Screw Down Roofs									
	R-10	10	0.153	0.082	0.056	0.043	0.035	0.029	0.025
	R-11	11	0.139	0.078	0.054	0.042	0.034	0.028	0.025
	R-13	13	0.130	0.075	0.053	0.041	0.033	0.028	0.024
Filled Cavity with Thermal Blocks									
	R19 + R-10	29	0.041	0.033	0.028	0.024	0.021	0.0198	0.017
(Multiple R-values are listed in order from inside to outside)									

TABLE B-21B
ASSEMBLY *U*-FACTORS FOR ATTIC ROOFS WITH WOOD JOISTS

Rated *R*-Value of Insulation Alone	Overall *U*-Factor for Entire Assembly
Wood-framed attic, standard framing	
None	0.613
R-11	0.091
R-13	0.081
R-19	0.053
R-30	0.034
R-38	0.027
R-49	0.021
R-60	0.017
R-71	0.015
R-82	0.013
R-93	0.011
R-104	0.010
R-115	0.009
R-126	0.008
Wood-framed attic, advanced framing	
None	0.613
R-11	0.088
R-13	0.078
R-19	0.051
R-30	0.032
R-38	0.026
R-49	0.020
R-60	0.016
R-71	0.014
R-82	0.012
R-93	0.011
R-104	0.010
R-115	0.009
R-126	0.008
Wood joists, single rafter roof	
None	0.417
R-11	0.088
R-13	0.078
R-15	0.071
R-19	0.055
R-21	0.052
R-25	0.043
R-30	0.036
R-38	0.028

cent full-depth insulation, 5-percent half-depth insulation, and 10-percent joists.

b. Attic roof, advanced framing: Full and even depth of insulation extending to the outside edge of exterior walls. Weighting factors are 90-percent full-depth insulation and 10-percent joists.

c. Single-rafter roof: An attic roof where the roof sheathing and ceiling are attached to the same rafter. Weighting factors are 90-percent full-depth insulation and 10-percent joists.

TABLE B-22
ASSEMBLY *U*-FACTORS FOR ATTIC ROOFS WITH STEEL JOISTS (4.0 FT ON CENTER)

Rated *R*-Value of Insulation Area	Overall *U*-Factor for Entire Assembly
R-0	U-1.282
R-4	U-0.215
R-5	U-0.179
R-8	U-0.120
R-10	U-0.100
R-11	U-0.093
R-12	U-0.086
R-13	U-0.080
R-15	U-0.072
R-16	U-0.068
R-19	U-0.058
R-20	U-0.056
R-21	U-0.054
R-24	U-0.049
R-25	U-0.048
R-30	U-0.041
R-35	U-0.037
R-38	U-0.035
R-40	U-0.033
R-45	U-0.031
R-50	U-0.028
R-55	U-0.027

For SI: 1 foot = 304.8 mm.

B2.4.4.2 Rated *R*-value of insulation.

B2.4.4.2.1 For attics and other roofs, the rated *R*-value of insulation is for insulation installed both inside and outside the roof or entirely inside the roof cavity.

B2.4.4.2.2 Occasional interruption by framing members is allowed but required that the framing members be covered with insulation when the depth of the insulation exceeds the depth of the framing cavity.

B2.4.4.2.3 Insulation in such roofs shall be permitted to be tapered at the eaves where the building structure does not allow full depth.

B2.4.4.2.4 For single-rafter roofs, the requirement is the lesser of the values for attics and other roofs and those listed in Table B-21A.

TABLE B-21A
Single Rafter Roofs

Minimum Insulation R-Value or Maximum Assembly *U*-Factor		
Wood Rafter Depth, *d* (actual)		
$d < 8$ in.	$8 < d < 10$ in.	$10 < d < 12$ in.
R-19 U-0.055	R-30 U-0.036	R-38 U-0.028

B2.4.4.3 *U*-factors for attic roofs with wood joists. *U*-factors for attic roofs with wood joists shall be taken from Table B-21B. It is not acceptable to use these *U*-factors if the framing is not wood. For attic roofs with steel joists, see Section B2.4.5.

B2.4.5 Attic roofs with steel joists.

B2.4.5.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a roof supported by steel joists with insulation between the joists. The assembly represents a roof in many ways similar to a roof with insulation entirely above deck and a metal building roof. It is distinguished from the metal building roof category in that there is no metal exposed to the exterior. It is distinguished from the roof with insulation entirely above deck in that the insulation is located below the deck and is interrupted by metal trusses that provide thermal bypasses to the insulation. The *U*-factor includes R-0.17 for exterior air film, R-0 for metal deck, and R-0.61 for interior air film heat flow up. The performance of the insulation/framing layer is calculated using the values in Table B-18.

B2.4.5.2 *U*-factors for attic roofs with steel joists shall be taken from Table B-22.

B2.5 Floors.

B2.5.1 General. The buffering effect of crawl spaces or parking garages shall not be included in *U*-factor calculations. See Section B2.5.5 for slab-on-grade floors.

B2.5.2 Mass floors.

B2.5.2.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is continuous insulation over or under a solid concrete floor. The *U*-factor includes R-0.92 for interior air film—heat flow down, R-1.23 for carpet and rubber pad, R-0.50 for 8 inches (203 mm) concrete, and R-0.46 for semi-exterior air film. Added insulation is continuous and uninterrupted by framing. Framing factor is zero.

B2.5.2.2 Rated *R*-value of insulation for mass floors.

B2.5.2.2.1 *The rated R-value of insulation is for continuous insulation* uninterrupted by framing.

B2.5.2.2.2 Where framing, including metal and wood joists, is used, compliance shall be based on the maximum assembly *U-factor* rather than the minimum *rated R-value of insulation.*

B2.5.2.2.3 For waffle-slab floors, the *floor* shall be insulated either on the interior above the slab or on all exposed surfaces of the waffle.

B2.5.2.2.4 For *floors* with beams that extend below the floor slab, the floor shall be insulated either on the interior above the slab or on the exposed floor and all exposed surfaces of the beams that extend 24 inches (610 mm) and less below the exposed floor.

B2.5.2.3 *U*-factors for mass floors.

B2.5.2.3.1 The *U*-factors for mass floors shall be taken from Table B-23.

B2.5.2.3.2 It is not acceptable to use the *U*-factors in Table B-23 if the insulation is not continuous.

B2.5.3 Steel joist floors.

B2.5.3.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a floor where the insulation is either placed between the steel joists or is sprayed on the underside of the floor and the joists. In both cases, the steel provides a thermal bypass to the insulation. The *U*-factor includes R-0.92 for interior air film—heat flow down, R-1.23 for carpet and pad, R-0.25 for 4-inch (102 mm) concrete, R-0 for metal deck, and R-0.46 for semiexterior air film. The performance of the insulation/framing layer is calculated using the values in Table B-18.

B2.5.3.2 Rated *R*-value of insulation for steel joist floors.

B2.5.3.2.1 The first *rated R-value of insulation* is for uncompressed insulation installed in the cavity between steel joists or for spray-on insulation.

B2.5.3.2.2 It is acceptable for this insulation to also be *continuous insulation* uninterrupted by framing. All *continuous insulation* shall be installed either on the interior above the floor structure or below a framing cavity completely filled with insulation.

B2.5.3.3 *U*-factors for steel joist floors.

B2.5.3.3.1 *U*-factors for steel joist floors shall be taken from Table B-24.

B2.5.3.3.2 It is acceptable to use these *U*-factors for any steel joist floor.

B2.5.4 Wood-framed and other floors.

B2.5.4.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a floor attached directly to the top of the wood joist and with insulation located directly below the floor, with a ventilated airspace below the insulation. The heat flow path through the joist is calculated to be the same depth as the insulation. The *U*-factor includes R-0.92 for interior air film—heat flow down, R-1.23 for carpet and pad, R-0.94 for 0.75 inch (19 mm) wood subfloor, and R-0.46 for semi-exterior air film. The weighting factors are 91-percent insulated cavity and 9-percent framing.

B2.5.4.2 Rated *R*-value of insulation for wood-framed and other floors.

B2.5.4.2.1 The first rated R-value of insulation is for uncompressed insulation installed in the cavity between wood joists.

B2.5.4.2.2 It is acceptable for this insulation to also be continuous insulation uninterrupted by framing. All continuous insulation shall be installed either on the interior above the floor structure or below a framing cavity completely filled with insulation.

TABLE B-23
ASSEMBLY *U*-FACTORS FOR MASS FLOORS

Framing Type & Spacing Width (actual depth)	Cavity Insulation *R*-Value: Rated/ (effective installed)	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Floor Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation																			
			R-1.0	R-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Concrete Floor with Rigid Foam																						
	None(0.0)	0.322	0.243	0.196	0.164	0.141	0.123	0.110	0.099	0.090	0.083	0.076	0.071	0.066	0.062	0.058	0.055	0.043	0.036	0.030	0.026	0.023
Concrete Floor with Pinned Boards																						
	R-4.2(4.2)	0.137	0.121	0.108	0.097	0.089	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.037	0.031	0.027	0.024	0.021
	R-6.3(6.3)	0.107	0.096	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.054	0.052	0.049	0.047	0.045	0.043	0.041	0.034	0.029	0.025	0.023	0.02
	R-8.3(8.3)	0.087	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.032	0.027	0.024	0.022	0.019
	R-10.4(10.4)	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023	0.021	0.019
	R-12.5(12.5)	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.028	0.025	0.022	0.020	0.018
	R-14.6(14.6)	0.056	0.053	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.034	0.033	0.032	0.031	0.027	0.023	0.021	0.019	0.017
	R-16.7(16.7)	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.034	0.032	0.031	0.030	0.030	0.029	0.025	0.022	0.020	0.018	0.017
Concrete Floor with Spray-on Insulation																						
(1 in.)	R-4(4.0)	0.141	0.123	0.11	0.099	0.090	0.083	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.037	0.031	0.027	0.024	0.021
(2 in.)	R-8(8.0)	0.09	0.083	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.032	0.028	0.024	0.022	0.020
(3 in.)	R-12(12.0)	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.036	0.034	0.033	0.028	0.025	0.022	0.02	0.018
(4 in.)	R-16(16.0)	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.026	0.023	0.020	0.018	0.017
(5 in.)	R-20(20.0)	0.043	0.041	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.023	0.021	0.019	0.017	0.016
(6 in.)	R-24(24.0)	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.021	0.019	0.018	0.016	0.015

For SI: 1 inch = 25.4 mm.

TABLE B-24
ASSEMBLY *U*-FACTORS FOR STEEL JOIST FLOORS

Framing Type & Spacing Width (actual depth)	Cavity Insulation *R*-Value: Rated/ (effective installed) [see Table B-18]	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Floor Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation																		
			R-1.0	R-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Steel Joist Floor with Rigid Foam																					
	None(0.0)	0.35	0.259	0.206	0.171	0.146	0.127	0.113	0.101	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.03	0.026	0.023
Steel Joist Floor with Spray-on Insulation																					
(1 in.)	R-4(3.88)	0.148	0.129	0.114	0.103	0.093	0.085	0.078	0.073	0.068	0.064	0.06	0.056	0.053	0.051	0.048	0.046	0.037	0.032	0.027	0.024	0.021
(2 in.)	R-8(7.52)	0.096	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.054	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.033	0.028	0.025	0.022	0.020
(3 in.)	R-12(10.8)	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023	0.021	0.019
(4 in.)	R-16(13.92)	0.060	0.056	0.053	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.034	0.032	0.031	0.027	0.024	0.021	0.019	0.018
(5 in.)	R-20(17.0)	0.050	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.030	0.029	0.025	0.022	0.020	0.018	0.017
(6 in.)	R-24(19.68)	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.024	0.021	0.019	0.017	0.016
Steel Joist Floor with Batt Insulation																					
	None(0.0)	0.350	0.259	0.206	0.171	0.146	0.127	0.113	0.101	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.030	0.026	0.023
	R-11(10.01)	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.030	0.026	0.023	0.021	0.019
	R-13(11.7)	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.034	0.029	0.025	0.022	0.020	0.018
	R-15(13.2)	0.062	0.059	0.055	0.052	0.05	0.047	0.045	0.043	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.028	0.024	0.022	0.020	0.018
	R-19(16.34)	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.026	0.023	0.020	0.018	0.017
	R-21(17.64)	0.049	0.047	0.044	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020	0.018	0.017
	R-25(20.25)	0.043	0.041	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.023	0.021	0.019	0.017	0.016
	R-30C(23.70)	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.025	0.024	0.021	0.019	0.018	0.016	0.015
	R-30(23.7)	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.025	0.024	0.021	0.019	0.018	0.016	0.015
	R-38C(28.12)	0.032	0.031	0.030	0.029	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.020	0.018	0.016	0.015	0.014
	R-38(28.12)	0.032	0.031	0.030	0.029	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.020	0.018	0.016	0.015	0.014

For SI: 1 inch = 25.4 mm.

TABLE B-25
ASSEMBLY *U*-FACTORS FOR WOOD JOIST FLOORS

Framing Type & Spacing Width (actual depth)	Cavity Insulation *R*-Value: Rated/ (effective installed)	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Floor Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation																			
			R-1.0	R-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Wood Joists																						
(5.5 in.)	None (0.0)	0.282	0.220	0.180	0.153	0.132	0.117	0.105	0.095	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.042	0.035	0.030	0.026	0.023
	R-11 (11.0)	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.030	0.026	0.023	0.020	0.019
	R-13 (13.0)	0.066	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.028	0.025	0.022	0.020	0.018
	R-15 (15.0)	0.060	0.057	0.053	0.05	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.027	0.024	0.021	0.019	0.017
	R-19 (18.0)	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020	0.018	0.017
	R-21 (21.0)	0.046	0.043	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.023	0.021	0.019	0.017	0.016
(7.25 in.)	R-25 (25.0)	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.025	0.025	0.024	0.022	0.019	0.018	0.016	0.015
	R-30C (30.0)	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.020	0.018	0.016	0.015	0.014
(9.25 in.)	R-30 (30.0)	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.020	0.018	0.016	0.015	0.014
(11.25 in.)	R-38C (38.0)	0.027	0.026	0.025	0.025	0.024	0.024	0.023	0.022	0.022	0.021	0.021	0.020	0.020	0.020	0.019	0.019	0.017	0.016	0.015	0.014	0.013
(13.25 in.)	R-389 (38.0)	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.021	0.021	0.020	0.020	0.019	0.019	0.019	0.017	0.016	0.015	0.014	0.013

For SI: 1 inch = 25.4 mm.

B2.5.4.3 *U*-factors for wood-framed floors

B2.5.4.3.1 *U-factors* for *wood-framed floors* shall be taken from Table B-25.

B2.5.4.3.2 It is not acceptable to use these *U-factors* if the framing is not wood.

B2.5.5 Slab-on-grade floors.

B2.5.5.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a slab floor of 6 inches (152 mm) concrete poured directly on to the earth, the bottom of the slab is at grade line, and soil conductivity is 0.75 Btu/h·ft²°F. In contrast to the *U*-factor for floors, the F-factor for slab-on-grade floors is expressed per lineal foot of building perimeter. F-factors are provided for unheated slabs and for heated slabs. Unheated slab-on-grade floors do not have heating elements, and heated slab-on-grade floors do have heating elements within or beneath the slab. F-factors are provided for three insulation configurations:

a. *Horizontal insulation:* Continuous insulation is applied directly to the underside of the slab and extends inward horizontally from the perimeter for the distance specified or continuous insulation is applied downward from the top of the slab and then extends horizontally to the interior or the exterior from the perimeter for the distance specified.

b. *Vertical insulation:* Continuous insulation is applied directly to the slab exterior, extending downward from the top of the slab for the distance specified.

c. *Fully insulated slab:* Continuous insulation extends downward from the top of the slab and along the entire perimeter and completely covers the entire area under the slab.

B2.5.5.2 Rated *R*-value of insulation for slab-on-grade floors.

B2.5.5.2.1 The rated *R*-value of insulation shall be installed around the perimeter of the slab-on-grade floor to the distance specified.

Exception: For a monolithic slab-on-grade floor, the insulation shall extend from the top of the slab-on-grade to the bottom of the footing.

B2.5.5.2.2 Insulation installed outside the foundation wall shall extend from the top of the slab or downward to at least the bottom of the slab and then horizontally to a minimum of the distance specified. The horizontal insulation extending outside of the foundaiton shall be covered by pavement or by soil a minimum of 10 inches (254 mm) thick.

B2.5.5.3 F-factors for slab-on-grade floors.

B2.5.5.3.1 F-factors for slab-on-grade floors shall be taken from Table B-26.

B2.5.5.3.2 These F-factors are acceptable for all slab-on-grade floors.

B3.1 Calculation procedures.

B3.1.1 Cooling system design loads. Cooling system design loads, for the purpose of sizing HVAC systems and equipment, shall be determined in accordance with one of the procedures described in Chapter 26 of the *ASHRAE Handbook of Fundamentals* or ACCA Manual N, *Commercial Load Calculation.*

B3.1.2 Interior design conditions. Indoor design temperature and humidity conditions for general comfort applications shall be in accordance with the comfort criteria established in ANSI/ASHRAE 55-92, *Thermal Environmental Conditions for Human Occupancy,* or Chapter 8 of the 2001 *ASHRAE Handbook of Fundamentals*, except that winter humidification and summer dehumidification are not required.

B3.1.3 Exterior design conditions. Outdoor design conditions shall be selected from the *ASHRAE Handbook of Fundamentals,* or from data obtained from the National Climatic Center or a similar recognized weather data source. Cooling design temperatures shall be no greater than the temperature listed in the 2.0-percent column or statistically similar 0.5-percent annualized value. Heating design temperatures shall be no lower than the temperature listed in the 99-percent column or statistically similar 0.2-percent annualized value.

Exception: Where necessary to assure the prevention of damage to the building or to material and equipment within the building, the 1-percent column for cooling may be used.

B4.1 Lighting calculation procedures.

B4.1.1 Luminaire wattage. Luminaire wattage incorporated into the installed interior lighting power shall be determined in accordance with the following criteria:

1. The wattage of incandescent or tungsten-halogen luminaires with medium screw base sockets and not containing permanently installed ballasts shall be the maximum labeled wattage of the luminaire.
2. The wattage of luminaires with permanently installed or remote ballasts or transformers shall be the operating input wattage of the maximum lamp/auxiliary combination based on values from the auxiliary manufactuer's literature or recognized testing laboratories.
3. The wattage of line-voltage lighting track and plug-in busway that allow the addition and/or relocation of luminaires without altering the wiring of the system shall be the specified wattage of the luminaires included in the system with a minimum of 30 watts per linear foot.
4. The wattage of low-voltage lighting track, cable conductor, rail conductor, and other flexible lighting systems that allow the addition and/or relocation of luminaires without altering the wiring of the system shall be the specified wattage of the transformer supplying the system.
5. The wattage of all other miscellaneous lighting equipment shall be the specified wattage of the lighting equipment.

TABLE B-26
ASSEMBLY F-FACTORS FOR SLAB-ON-GRADE FLOORS

Insulation Description	Rated *R*-Value of Insulation												
	R-0	R-5	R-7.5	R-10	R-15	R-20	R-25	R-30	R-35	R-40	R-45	R-50	R-55
Unheated Slabs													
None	0.73												
12 in. horizontal		0.72	0.71	0.71	0.71								
24 in. horizontal		0.70	0.70	0.70	0.69								
36 in. Horizontal		0.68	0.67	0.66	0.66								
48 in. horizontal		0.67	0.65	0.64	0.63								
12 in. vertical		0.61	0.60	0.58	0.57	0.567	0.565	0.564					
24 in. vertical		0.58	0.56	0.54	0.52	0.510	0.505	0.502					
36 in. vertical		0.56	0.53	0.51	0.48	0.472	0.464	0.460					
48 in. vertical		0.54	0.51	0.48	0.45	0.434	0.424	0.419					
Fully insulated slab		0.46	0.41	0.36	0.30	0.261	0.233	0.213	0.198	0.186	0.176	0.168	0.161
Heated Slabs													
None	1.35												
12 in. horizontal		1.31	1.31	1.30	1.30								
24 in. horizontal		1.28	1.27	1.26	1.25								
36 in. horizontal		1.24	1.21	1.20	1.18								
48 in. horizontal		1.20	1.17	1.13	1.11								
12 in. vertical		1.06	1.02	1.00	0.98	0.968	0.964	0.961					
24 in. vertical		0.99	0.95	0.90	0.86	0.843	0.832	0.827					
36 in. vertical		0.95	0.89	0.84	0.79	0.762	0.747	0.740					
48 in. vertical		0.91	0.85	0.78	0.72	0.688	0.671	0.659					
Fully insulated slab		0.74	0.64	0.55	0.44	0.373	0.326	0.296	0.273	0.255	0.239	0.227	0.217

For SI: 1 inch = 25.4 mm.

APPENDIX 13-C

SUPPLEMENTAL INFORMATION FOR SUBCHAPTER 13-6

13-C1.0 General requirements.

13-C1.1 Baseline features. Baseline features for compliance with Method A shall be as described in Section 13-613. The following features are utilized in compliance Method A of Subchapter 6 of the code as "baseline" features. These features are not code minimum efficiencies; rather, they represent standard reference design building component options utilized in establishing a budget that the building shall not exceed to comply with the code.

13-C1.2 Building envelope, insulation. All *R*-values referenced in this chapter refer to the R-values of the added insulation only. The *R*-values of structural building materials such as framing members, concrete blocks or gypsum board shall not be included. Insulation levels shall be achieved with insulation products tested and rated according to the procedures recognized by the Federal Trade Commission (FTC) in 16 CFR Part 460.

See Section 13-104.4.3 for compliance requirements pertaining to insulation installed in locations where the *R*-value is not readily apparent or the FTC label is not affixed to the installed product.

13-C1.2.1 When installing two layers of bulk or board insulation, the *R*-values of each material may be added together for a total *R*-value. When installing two separate reflective insulation products in layers, the total *R*-value of the system shall have been achieved by testing under FTC regulations, 16 CFR Part 460.

13-C1.2.2 Insulation that has been compressed to 85-percent or less of the manufacturer's rated thickness for the product shall use the R-values given in Table 13-C1.2.2. These values are to be used except where data developed by an independent testing laboratory is provided and approved by the Florida Building Commission.

TABLE 13-C1.2.2
R-VALUES OF COMPRESSED INSULATION

% OF ORIGINAL THICKNESS	R-5	R-7	R-11	R-14	R-19	R-30	R-38
90	5	6	10	13	18	28	36
80	4	6	10	12	17	26	33
70	4	5	9	11	15	24	30
60	3	5	8	10	14	22	27
50	3	4	7	9	12	18	24
40	2	4	6	8	10	15	20
30	2	3	4	6	8	12	16
20	20	2	2	3	4	10	10

13-C1.2.3 The thermal insulation materials listed below shall comply with the requirements of their respective ASTM standard specification and shall be installed in accordance with their respective ASTM installation practice in Table 13-C1.2.3.

13-C2.0 General criteria for the building envelope.

13-C2.1 Glazing. *U*-factors (thermal transmittances) or SHGC for glazed fenestration products shall be determined in accordance with NFRC 100, *Procedure for Determining Fenestration Product U-factors*, or NFRC 200, *Procedures for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence*, by an accredited, independent laboratory and labeled and certified by the manufacturer. See Section 13-104.4.5

13-C2.1.1 Unlabeled windows. When a manufacturer has not determined *U*-factor or SHGC in accordance with NFRC 100 or 200 for a particular product line, compliance with the building envelope requirements of this code shall be determined by assigning such products default *U*-factor or SHGC in accordance with Table 13-C2.1.1. Product features must be verifiable for the product to qualify for the default value associated with those features. Where the existence of a particular fea-

TABLE 13-C1.2.3
INSULATION INSTALLATION STANDARDS

Insulation Material	Standard Specification	Installation Practice
Mineral Fiber Batt/Blanket	ASTM C 665	ASTM C 1320
Mineral Fiber Loose Fill	ASTM C 764	ASTM C 1015
Cellulose Loose Fill	ASTM C 739	ASTM C 1015
Polystyrene Foam	ASTM C 578	–
Polyisocyanurate Foam	ASTM C 1289	–
Reflective	ASTM C 1224	ASTM C 727
Radiant Barrier	ASTM C 1313	ASTM C 1158
Vermiculite	ASTM C 516	–
Perlite	ASTM C 549	–
Spray-Applied Rigid Cellular Polyurethane Foam	ASTM C 1029	–
Interior Radiation Control Coating Systems	–	ASTM C 1321

ture cannot be determined with reasonable certainty, the product shall not receive credit for that feature. Where a composite of materials from two different product types are used, the product shall be assigned the higher *U*-factor or SHGC.

TABLE 13-C2.1.1
DEFAULT WINDOW ENERGY VALUES
FOR RESIDENTIAL APPLICATIONS

Type	U-factor	Solar Heat Gain Coefficient (SHGC)
Single pane clear	1.30	0.75
Single pane tine	1.30	0.64
Double pane clear	0.87	0.66
Double pane tint	0.87	0.55

13-C2.1.2 The overhang length for adjustable exterior shading devices shall be determined for the overhang at its most extended position.

13-C2.1.3 All glazing areas of a residence, including windows, sliding glass doors, glass in doors, skylights, etc., shall include the manufacturer's frame area in the total window area. Window measurements shall be as specified on the plans and specifications for the residence.

When a window in existing exterior walls is enclosed by an addition, an amount equal to the area of this window may be subtracted from the glazing area for the addition for that overhang and orientation.

13-C2.2 Walls.

13-C2.2.1 Exterior or adjacent walls consisting of more than one construction type or *R*-value shall be treated as separate walls.

13-C2.2.2 Walls separating an addition from the preexisting conditioned spaces shall not be included in the calculation.

13-C2.2.3 Common walls separating conditioned tenancies shall not be included as heat transfer areas in the as-built or baseline house envelope calculation.

13-C2.2.4 Walls that separate conditioned living space from unconditioned attic space, such as walls supporting cathedral ceilings and gambrel roofs, and skylight shafts, etc., shall be considered ceiling area for this calculation procedure.

13-C2.2.5 Net wall area (gross wall area of the building less all doors and windows) taken from the plans and specifications shall be used in the compliance calculation.

13-C2.3 Doors.

13-C2.3.1 Door areas shall be determined from the measurements specified on the plans for each exterior and adjacent door.

13-C2.3.2 All sliding glass doors and glass areas in doors shall be included in the glazing calculation and meet the requirements of Section 13-601 unless the glass is less than one-third of the area of the door.

13-C2.4 Ceilings.

13-C2.4.1 If different ceiling types or *R*-values are used in a house, each type or *R*-value shall be treated as a separate heat transfer area.

13-C2.4.2 Common ceilings shall not be included in the house envelope calculation.

13-C2.4.3 Ceilings separating an addition from the preexisting conditioned spaces shall not be included in the calculation.

13-C2.4.4 As-built ceiling area shall be the actual ceiling area exposed to attic or single assembly roof conditions, including walls that separate conditioned living space from unconditioned attic space. Baseline ceiling area shall be the total floor area within the conditioned space located directly below the roof.

13-C2.5 Floors.

13-C2.5.1 If the floor area consists of more than one type of construction or *R*-value, each floor system shall be treated as a separate floor heat transfer area.

13-C2.5.2 Common floors shall not be included in the calculation.

13-C2.5.3 Floors separating an addition from the preexisting conditioned spaces shall not be included in the calculation.

13-C2.5.4 Slab-on-grade floor perimeters shall be determined based on the linear footage of the slab which encloses the conditioned space, including both exterior and adjacent wall linear footage for single-family residential applications. In multiple-family applications, the slab linear footage between two conditioned tenancies shall be ignored.

13-C2.5.5 Raised floor areas shall be determined based on the conditioned floor area of floors above unconditioned space.

13-C3.0 Infiltration and internal gains.

13-C3.1 Infiltration area determination. The area to be considered in the infiltration calculation of Method A shall be the total conditioned floor area of the building.

13-C3.2 Infiltration and internal gains shall be considered the same for both the baseline and as-built conditions.

13-C3.3 Infiltration barriers for frame construction. The following building materials and systems qualify as infiltration barriers when installed on the exterior of frame wall construction. Analogous methods apply to raised floor and ceiling construction.

13-C3.3.1 Plastic sheeting. Plastic sheeting products shall be considered air infiltration barriers when applied to a frame wall underneath an exterior finish and the following sealing requirements are met:

1. Sheeting shall be attached to the top plate by either:
   a. Mechanical fasteners and mastic, or

b. Wrapping the sheeting over the top plate, then mechanically fastening it to the indoor faces of the plates. Sheeting shall be wrapped over the top plate prior to the trusses being set.

2. Sheeting shall be attached to the bottom plate by either:
   a. Mechanical fasteners and mastic to the bottom plate, foundation wall, header and end joists, floor deck or slab edge, or
   b. Wrapping the sheeting under the bottom plate, then mechanically fastening it to the indoor faces of the plates.
3. Sheeting shall be attached around doors and windows by either:
   a. Mechanical fasteners and mastic to the jams, or
   b. Mechanical fasteners to the framing members and mastic or pressure-sensitive tape with acrylic adhesive to metal or plastic mounting fins, or
   c. Wrapping the sheeting around the door or window opening, then attaching with mechanical fasteners to the indoor face of the framing.
4. Sheeting shall be attached with mechanical fasteners at all seams. All seams shall be sealed by either applying a mastic or a pressure sensitive tape with acrylic adhesive to the lapped ends. Rubber-based adhesive tapes shall not be used for this purpose.

Tapes of any type are not acceptable for sealing plastic sheeting to wood or masonry building components.

13-C3.3.2 Wood sheathing. Wood sheathing panels shall be considered air infiltration barriers when applied to a frame wall underneath an exterior finish and the following sealing requirements are met:

1. Joints formed by the square edges of adjoining panels shall be backed by a framing member. The joints between panels shall be sealed, or both adjoining panels sealed to the framing member using a mastic. For joints formed by tongue and groove edges, the groove of the panels shall be filled with mastic prior to mating the panels.
2. The panels shall be sealed to the top plate using a mastic.
3. The panels shall be sealed to the bottom plate, floor deck, or header and end joists using mastic.
4. The panels shall be sealed to the jambs or mounting fins of doors and windows using a mastic.

Tapes of any type are not acceptable sealants for sealing wood sheathing to wood members, mounting fins, or masonry.

13-C3.3.3 Nonwood sheathing. Nonwood sheathing panels including foam insulation boards, and foil or plastic faced boards of other materials, shall be considered air infiltration barriers when applied to a frame wall underneath an exterior finish and the following sealing requirements are met:

1. Joints between adjoining panels shall be sealed using one of the methods given for wood sheathing boards in Section 13-C4.1.2(1) above or, joints between adjoining panels shall be sealed by pressure sensitive tape with acrylic adhesive. Rubber-based adhesive tapes shall not be used for this purpose.
2. The panels shall be sealed to the top plate using a mastic.
3. The panels shall be sealed to the bottom plate, foundation wall, header and end joists, floor deck, or slab using mastic.
4. The panels shall be sealed to the jams or mounting fins of doors and windows using a mastic. Acrylic-based tape may be used to seal metal and plastic door and window mounting fins to the sheathing panels.

Tapes of any type are not acceptable sealants for sealing nonwood sheathing to wood or masonry building components.

13-C3.3.4 Stucco infiltration barrier. Stucco on exterior frame walls shall may qualify as an infiltration barrier if the following conditions are met:

1. Top plates, sill plates and sole plates or foundation joints to the stucco shall be sealed.
2. All holes in the outer wall face shall be patched. The entire exterior wall shall be coated with a weather-resistant stucco layer of at least a $^5/_8$ inch (16 mm) thickness for cementitious stucco or $^1/_2$ inch (12.7 mm) for polymeric stucco.

13-C3.4 Infiltration criteria for log wall construction. The following building materials, systems, or testing qualify as meeting the infiltration criteria for log wall construction:

13-C3.4.1 Continuous groove logs. A continuous spline shall be caulked in place, or sealed with compressible foam gasket tape.

13-C3.4.2 Single, double and/or multiple tongue and groove joints. Tongue and groove joints shall be caulked in place or sealed with compressible foam gasket tape.

13-C3.4.3 Testing. The wall system shall have been tested by either a whole house air infiltration test procedure approved by the Department of Community Affairs or by ASTM E 283 to demonstrate a maximum air change per hour (ACH) rate of 17.5 at 50 pascals of pressure difference. Air flow rates in cubic feet per minute (CFM) shall be converted to air changes per hour (ACH).

13-C4.0 Heating, ventilating and air conditioning.

13-C4.1 General.

13-C4.1.1 Existing equipment. Minimum efficiencies for existing equipment shall be assumed from Tables 13-C4.1.1A and 13-C4.1.1B by the age of the unit unless documentation is available to demonstrate a higher efficiency.

TABLE 13-C4.1.1A
COOLING SYSTEM ASSUMED, MINIMUM RATINGS BY DATE PERMITTED AIR CONDITIONERS

Date Building Permitted	Assumed Rating
Prior to 1979, average	EER 6.1
3/15/79 - 8/31/82	EER 6.1
9/1/82 - 5/31/84	EER 6.8
1/1/84 - 12/30/88	SEER 7.8
1/1/89 - 12/30/90	SEER 7.8
1/1/91 - 12/30/91	SEER 8.9
1/1/92 - 12/7/07	SEER 10.0
12/8/07 - present	SEER 13.0

TABLE 13-C4.1.1B
HEATING SYSTEM ASSUMED, MINIMUM RATINGS BY DATE PERMITTED HEAT PUMPS

Date Building Permitted	Assumed Rating
Prior to 1979, average	COP 2.2
3/15/79 - 8/31/82	COP 2.2
9/1/82 - 5/31/84	COP 2.2
6/1/84 - 12/31/86	COP 2.5
1/1/87 - 12/30/90	COP 2.7
1/1/91 - 12/30/91	HSPF 6.8
1/1/92 - 12/7/07	HSPF 6.8
12/8/07 - present	HSPF 7.7

13-C4.1.2 Multiple heating or cooling systems. Where two or more systems of the same type are installed with different levels of efficiency serving different parts of the house, a capacity-weighted performance rating shall be used to determine compliance.

13-C5.0 Air distribution systems.

13-C5.1 Ducts in conditioned space. For ductwork to qualify as being in conditioned space, it shall be located on the conditioned side of the envelope insulation and be situated in such a manner that any air leakage will be discharged into the conditioned space. Systems having no return air ducts or plenums between the air intake and the air handler, such as those in mechanical closets which communicate with the conditioned space, shall be considered systems with return ducts in conditioned space. Systems which have no ducts, such as PTACs and room air conditioners, qualify as ducts in conditioned space.

13-C5.2 Multiple duct systems. Where parts of the structure are to be served by ductwork of different *R*-values, or by ducts in conditioned space, the duct calculation shall be performed by one of the following methods.

1. The smallest *R*-value may be used.
2. Each of the different duct *R*-values may be multiplied by the total duct area that has this insulation rating. The results are then summed and divided by the total area of the ductwork.

13-C5.3 Additions. If ducts are added to supply conditioned air to the addition, the ducts shall meet or exceed the minimum *R*-value requirements of this code. If conditioning is provided by existing ducts and registers or diffusers, a baseline duct shall be assumed.

13-C6.0 Service hot water.

13-C6.1 Water heater area determination. Water heating requirements are estimated based on the number of bedrooms in the residence. Any room which has an area of 70 square feet (7 m^2) or more and a clothes storage closet, and is not part of the common living area, shall be considered a bedroom for calculation purposes.

13-C6.2 Multiple water heating systems. Where two or more water heating systems are installed with different levels of efficiency, a single capacity-weighted efficiency shall be calculated for determining compliance with this code.

SUB-APPENDIX 13-2C

SUPPLEMENTAL CRITERIA FOR THE ALTERNATE RESIDENTIAL POINTS SYSTEM METHOD

13-2C1.0 General requirements.

13-2C1.1 Baseline features. The features in Section 13-613 are utilized in compliance Method A as "baseline" features. These features are not code minimum efficiencies; rather, they represent standard reference design building component options utilized in establishing a budget that the building shall not exceed to comply with the code.

13-2C1.2 Interpolation from tables. Interpolation of multipliers for the Alternate Residential Points System Method is allowed by Equation 13-2C1.2 where rated efficiencies of installed components fall within a range. Extrapolations of multipliers above the highest value given or below the lowest values given shall not be permitted.

$$M_i = \frac{M_t - [(R_i - R_t) \times (M_t - M_n)]}{R_n - R_t} \quad \textbf{(Equation 13-2C1.2)}$$

Where:

M_i = Multiplier for rating of installed component

M_n = Multiplier for next (more efficient) range

M_t = Multiplier for range within which installed component falls

R_i = Efficiency rating of installed component

R_n = Reference rating for next (more efficient) range

R_t = Reference rating for range within which installed component falls

13-C2.0 Building envelope performance criteria.

13-C2.1 Windows

13-2C.2.1.1 Glass multipliers. Glass multipliers for the Alternate Residential Points System Method shall be as provided on Form 600A and expanded by Tables 13-2C2.1.1A through 13-2C2.1.1C of this appendix.

13-2C2.1.2 Assumptions. Three basic underlying assumptions were used in development of the FLA/RES window load correlation coefficients:

1. Frame area equals 25 percent of the total window area.
2. Frame *U*-factor equals glass *U*-factor equals overall *U*-factor.
3. Interior shading factor equals 0.70 in summer and 0.9 in winter.

The general equation for determining the window point multipliers is as follows:

$$PM = A_1 \times SC_o + A_2 \times U_o + A_3 \times (SC_o \times U_o) + A_4 \times SC_o^2 + A_5 \times U_o^2 \quad \textbf{(Equation 13-2C2.1.2A)}$$

Where:

PM = Point multipliers (load coefficient in kBtu/ft² of window)

SC_o = Overall shading coefficient of entire installed system including glass, frame and sash and interior treatments.

U_o = Overall *U*-factor of entire installed window system, including glass, frame and sash

A_i = Regression coefficients

Coefficients A_1 through A_5 vary by (1) season of the year, (2) by climate zone and (3) and by glass orientation (8 + horizontal = 9), such that there are 54 sets of A-coefficients needed to fully describe the window point multipliers (load correlation coefficients in the *Florida Energy Code*).

The general equation for window shading is given as follows:

$$SHGC_t = (A_f \times SHGC_f + A_g \times SHGC_g)/A_w \quad \textbf{(Equation 13-2C2.1.2B)}$$

Where:

$SHGC_t$ = SHGC of total window system

A_f = frame area = 0.25

$SHGC_f$ = SHGC of the frame and sash

A_g = glass area = 0.75

$SHGC_g$ = SHGC of the glass

A_w = total window area = 1.00

The equation for the solution of $SHGC_f$ is as follows:

$$SHGC_f = k \times a \times U_f/h_o \quad \textbf{(Equation 13-2C2.1.2C)}$$

Where:

$SHGC_f$ = SHGC of the window frame and sash

k = frame shape factor = 1.00

a = solar absorptance of frame = 0.77

U_f = *U*-factor of frame and sash = U_g

h_o = exterior air film coefficient = 4.00 Btu/hr-ft²-F

On substitution, Equation 13-2C2.1.2 reduces to:

$$SHGC_f = 1.00 \times 0.77 \times U_g/ 4.00 = 0.1925 \times U_g$$

The overall solar heat gain coefficient ($SHGC_o$) of the installed window system and its treatments may be determined by multiplying the total solar heat gain coefficient ($SHGC_t$) by the interior window treatment coefficient (ITC) as follows:

$$SHGC_o = SHGC_t \times ITC \quad \textbf{(Equation 13-2C2.1.2D)}$$

Where:

$SHGC_o$ = Combined SHGC of glass, frame, sash, interior window treatments

ITC = Interior window treatment coefficient

Combining Equation 13-2C2.1.2B thru Equation 13-2C2.1.2D yields the following simplified general equation for $SHGC_o$:

$$SHGC_o = (0.048125 \times U_g + 0.75 \times SHGC_g) \times ITC$$

(Equation 13-2C2.1.2E)

A solar heat gain coefficient ($SHGC_i$) may also be defined in terms of a corresponding shading coefficient (SC_i) using the following constitutive relationship given by ASHRAE:

$$SHGC_i = SC_i \times 0.87$$ **(Equation 13-2C2.1.2F)**

Thus, Equation 13-2C2.1.2E can be recast in terms of a glass shading coefficient (SC_g) as follows:

$$SC_o = (0.55316 \times U_g + 0.75 \times SC_g) \times ITC$$

(Equation 13-2C2.1.2G)

Where:

SC_g = Shading coefficient at the center-of-glass

Or, more simply, in terms of the most likely window manufacturer's product specification ($SHGC_t$), the equation becomes:

$$SC_o = SHGC_t / 0.87 \times ITC$$

(Equation 13-2C2.1.2H)

13-2C2.1.3 Glass orientation. Multipliers are provided on Form 600A by the glass orientation: N, NE, E, SE, S, SW, W, NW or H (horizontal).

13-2C2.1.4 Glass types. Multipliers are provided on Form 600A by glazing type, either single- or double-paned glass with either clear or tinted shading.

Where a SHGC for glazed fenestration products (windows, glazed doors and skylights) has been determined in accordance with NFRC 200, *Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence*, by an accredited, independent laboratory and labeled and certified by the manufacturer to be 0.57 or lower, a more favorable multiplier may be obtained from Tables 13-2C2.1.1A through 13-2C2.1.1C based on the climate zone in which it will be installed.

13-2C2.1.5 Glass overhangs. Overhang factors shall be determined from Tables 6A-1 and 6A-10 on Form 600A by matching either the overhang ratio or the overhang length (in feet) with the orientation of the glass it shades. The overhang ratio shall be calculated by the following equation:

$$\text{OH Ratio} = \frac{OH_{Length}}{OH_{Height}}$$

13-2C2.1.5.1 To select the overhang factor by the overhang length, no part of the glass shall be more than 8 feet (2438 mm) below the overhang.

13-2C2.1.6 Between range calculation. In cases where an overhang length or solar heat gain coefficient falls between two glass percentage ranges and the glass type is the same throughout the addition, the specific glass percentage allowed may be determined by using the following equations:

Overhang (OH):

$$\text{Glass \% Allowed} = \text{Low\% Glass} + \frac{\text{High\% Glass} - \text{Low\% Glass}}{OH_{High\%} - OH_{Low\%}} \times [OH_{Installed} - OH_{Low\%}]$$

Solar heat Gain Coefficient (SHGC):

$$\text{Glass \% Allowed} = \text{Low\% Glass} + \frac{\text{High\% Glass} - \text{Low\% Glass}}{SHGC_{High\%} - SHGC_{Low\%}} \times [SHGC_{Installed} - SHGC_{Low\%}]$$

13-C2.2 Walls.

13-C2.2.1 Multipliers for lightweight concrete block shall be determined from Table 13-2C2.2.1. Light-weight block shall have an aggregate density of no greater than 105 pounds per cubic foot (1682 kg/m^3).

13-C2.2.2 Multipliers for polystyrene bead aggregate block shall be determined from Table 13-2C2.2.2. Polystyrene bead aggregate block shall be composed of at least 60 percent polystyrene beads by volume, and shall achieve at least an R-8 insulation value when tested to ASTM C 236.

13-2C2.2.3 Interpolation of multipliers for efficiencies falling within ranges may be made in accordance with Section 13-2C1.2 of this appendix.

13-2C2.3 Doors. Doors shall be identified as either exterior or adjacent, based on the type of wall in which they are located, and as wood or insulated. Multipliers for the type of door to be installed shall be determined from Tables 6A-3 and 6A-12 on Form 600A.

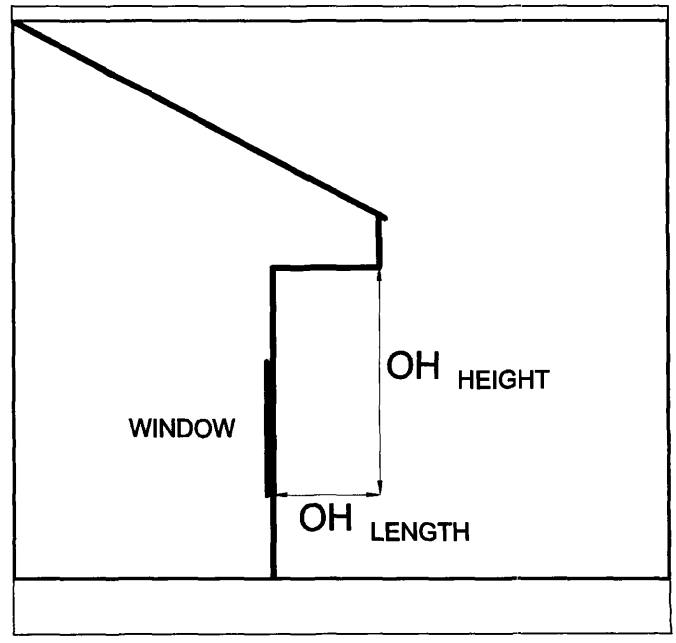


FIGURE 6.1

TABLE 13-2C2.1.1A
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 1, 2, 3

NORTH FLORIDA DEFAULT WINDOW POINT MULTIPLIERS

Single Pane: Default *U*-factor = 1.3								
Solar Heat Gain Coefficient	**0.60-0.56**	**0.55-0.51**	**0.50-0.46**	**0.45-0.41**	**0.40-0.36**	**0.35-0.31**	**0.30-0.26**	**0.25-0**
Summer:								
N	15.653	13.655	11.632	9.637	7.619	5.602	3.614	1.601
NE	25.108	22.329	19.518	16.745	13.939	11.136	8.373	5.576
E	36.576	32.840	29.057	25.325	21.545	17.768	14.041	10.267
SE	37.154	33.367	29.532	25.748	21.915	18.084	14.303	10.473
S	30.889	27.623	24.316	21.054	17.750	14.449	11.192	7.894
SW	34.846	31.256	27.621	24.035	20.403	16.773	13.193	9.567
W	33.301	29.831	26.318	22.852	19.343	15.836	12.377	8.874
NW	21.774	19.259	16.712	14.200	11.657	9.116	6.610	4.073
H	63.283	56.313	49.256	42.296	35.249	28.207	21.261	14.229
Winter:								
N	34.372	34.749	35.129	35.502	35.879	36.254	36.623	36.995
NE	33.421	33.874	34.331	34.782	35.236	35.690	36.136	36.586
E	28.826	29.622	30.429	31.225	32.032	32.839	33.635	34.442
SE	25.137	26.234	27.349	28.452	29.571	30.694	31.804	32.932
S	23.845	25.042	26.258	27.462	28.686	29.913	31.128	32.363
SW	26.976	27.933	28.904	29.866	30.842	31.821	32.789	33.773
W	30.859	31.523	32.195	32.857	33.527	34.196	34.856	35.523
NW	34.141	34.538	34.938	35.332	35.730	36.126	36.515	36.907
H	32.315	33.354	34.411	35.459	36.526	37.597	38.660	39.741

(continued)

TABLE 13-2C2.1.1A (continued)
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 1,2,3

SKYLIGHTS

Solar Heat Gain Coefficient	.481-.417	.416-.351	.350-.286	.285-.221	.22-.156	.155-.09	.89-.01
Summer	54.850	45.920	36.999	28.086	19.182	10.285	1.397
Winter	11.091	12.422	13.761	15.108	16.463	17.827	19.199

Double Pane: Default *U*-factor = 0.87								
Solar Heat Gain Coefficient	**0.50-0.46**	**0.45-0.41**	**0.40-0.36**	**0.35-0.31**	**0.30-0.26**	**0.25-0.21**	**0.20-0.16**	**0.15-0**
Summer:								
N	12.854	10.866	8.906	6.923	4.942	2.988	1.036	-0.965
NE	20.713	17.944	15.214	12.451	9.690	6.969	4.251	1.464
E	30.171	26.442	22.764	19.039	15.315	11.643	7.971	4.206
SE	30.708	26.929	23.201	19.425	15.650	11.926	8.202	4.381
S	25.488	22.234	19.025	15.776	12.528	9.324	6.123	2.839
SW	28.732	25.150	21.616	18.038	14.461	10.933	7.406	3.789
W	27.481	24.019	20.605	17.147	13.692	10.283	6.876	3.382
NW	17.981	15.477	13.007	10.506	8.007	5.543	3.081	0.556
H	52.565	45.607	38.743	31.794	24.851	18.002	11.158	4.138
Winter:								
N	25.735	26.095	26.448	26.805	27.160	27.508	27.856	28.210
NE	24.963	25.398	25.825	26.257	26.688	27.112	27.534	27.966
E	21.287	22.070	22.843	23.625	24.408	25.180	25.953	26.746
SE	18.143	19.228	20.301	21.391	22.483	23.564	24.647	25.762
S	17.052	18.238	19.413	20.607	21.805	22.991	24.180	25.405
SW	19.729	20.674	21.608	22.557	23.509	24.451	25.394	26.366
W	22.801	23.449	24.089	24.735	25.381	26.018	26.654	27.306
NW	25.522	25.903	26.278	26.656	27.033	27.403	27.771	28.148
H	23.141	24.181	25.213	26.263	27.319	28.365	29.416	30.499

TABLE 13-2C2.1.1B
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 4,5,6

CENTRAL FLORIDA DEFAULT WINDOW POINT MULTIPLIERS

Single Pane: Default *U*-factor = 1.3								
Solar Heat Gain Coefficient	**0.60-0.56**	**0.55-0.51**	**0.50-0.46**	**0.45-0.41**	**0.40-0.36**	**0.35-0.31**	**0.30-0.26**	**0.25-0**
Summer:								
N	22.362	19.786	17.179	14.608	12.007	9.408	6.846	4.253
NE	35.861	32.162	28.417	24.724	20.985	17.250	13.566	9.837
E	49.341	44.524	39.647	34.837	29.966	25.099	20.299	15.438
SE	47.026	42.405	37.726	33.112	28.441	23.774	19.171	14.511
S	36.765	32.993	29.174	25.407	21.593	17.782	14.023	10.217
SW	43.756	39.399	34.988	30.636	26.230	21.826	17.482	13.084
W	44.311	39.910	35.453	31.057	26.606	22.158	17.770	13.327
NW	30.755	27.475	24.154	20.879	17.564	14.251	10.984	7.677
H	82.534	73.595	64.543	55.616	46.577	37.544	28.634	19.613
Winter:								
N	15.495	15.635	15.777	15.916	16.057	16.198	16.336	16.477
NE	15.202	15.367	15.534	15.699	15.865	16.030	16.194	16.359
E	13.280	13.581	13.887	14.190	14.498	14.806	15.111	15.421
SE	11.818	12.226	12.640	13.050	13.467	13.885	14.299	14.719
S	11.246	11.693	12.147	12.597	13.055	13.514	13.968	14.430
SW	12.642	12.990	13.344	13.693	14.048	14.403	14.754	15.110
W	13.998	14.246	14.498	14.747	14.999	15.252	15.502	15.756
NW	15.426	15.575	15.726	15.874	16.024	16.173	16.320	16.468
H	15.912	16.289	16.672	17.053	17.440	17.830	18.216	18.609

(continued)

TABLE 13-2C2.1.1B (continued)
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 4,5,6

SKYLIGHTS

Solar Heat Gain Coefficient	.481-.417	.416-.351	.350-.286	.285-.221	.22-.156	.155-.09	.89-.01
Summer	70.588	59.150	47.772	36.304	24.897	13.499	2.113
Winter	5.853	6.329	6.809	7.292	7.779	8.268	8.761

Double Pane: Default *U*-factor = 0.87								
Solar Heat Gain Coefficient	0.50-0.46	0.45-0.41	0.40-0.36	0.35-0.31	0.30-0.26	0.25-0.21	0.20-0.16	0.15-0
Summer:								
N	18.078	15.517	12.993	10.438	7.886	5.370	2.857	0.280
NE	29.229	25.546	21.913	18.236	14.562	10.939	7.319	3.607
E	40.368	35.565	30.828	26.032	21.239	16.511	11.787	6.942
SE	38.495	33.888	29.346	24.747	20.152	15.620	11.092	6.449
S	29.943	26.189	22.487	18.738	14.993	11.298	7.606	3.820
SW	35.752	31.411	27.129	22.793	18.459	14.185	9.913	5.531
W	36.219	31.831	27.502	23.119	18.739	14.418	10.100	5.671
NW	25.029	21.764	18.544	15.285	12.028	8.816	5.607	2.315
H	68.105	59.186	50.389	41.482	32.581	23.801	15.028	6.030
Winter:								
N	11.416	11.548	11.677	11.807	11.938	12.066	12.194	12.325
NE	11.191	11.345	11.497	11.651	11.804	11.955	12.106	12.260
E	9.750	10.042	10.331	10.625	10.920	11.211	11.503	11.804
SE	8.576	8.975	9.371	9.773	10.176	10.575	10.975	11.386
S	8.142	8.584	9.021	9.466	9.912	10.353	10.797	11.253
SW	9.199	9.539	9.875	10.216	10.557	10.894	11.232	11.579
W	10.306	10.545	10.781	11.022	11.262	11.500	11.738	11.983
NW	11.350	11.489	11.625	11.763	11.900	12.035	12.169	12.307
H	11.386	11.761	12.133	12.512	12.893	13.271	13.650	14.042

TABLE 13-2C2.1.1C
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 7,8,9

SOUTH FLORIDA DEFAULT WINDOW POINT MULTIPLIERS

Single Pane: Default *U*-factor = 1.3								
Solar Heat Gain Coefficient	**0.60-0.56**	**0.55-0.51**	**0.50-0.46**	**0.45-0.41**	**0.40-0.36**	**0.35-0.31**	**0.30-0.26**	**0.25-0**
Summer:								
N	26.711	23.503	20.256	17.054	13.814	10.577	7.385	4.155
NE	42.060	37.600	33.086	28.634	24.127	19.624	15.183	10.688
E	60.515	54.528	48.468	42.492	36.444	30.401	24.442	18.411
SE	61.399	55.339	49.204	43.155	37.031	30.912	24.878	18.770
S	51.083	45.869	40.591	35.387	30.118	24.854	19.664	14.409
SW	56.262	50.617	44.901	39.263	33.555	27.850	22.222	16.524
W	53.940	48.479	42.950	37.496	31.974	26.456	21.013	15.502
NW	36.260	32.258	28.208	24.213	20.169	16.128	12.143	8.109
H	100.191	89.152	77.975	66.951	55.790	44.636	33.635	22.497
Winter:								
N	6.142	6.177	6.211	6.245	6.279	6.313	6.345	6.377
NE	5.999	6.051	6.103	6.155	6.207	6.259	6.311	6.362
E	5.158	5.286	5.416	5.545	5.675	5.806	5.936	6.068
SE	4.696	4.855	5.019	5.181	5.347	5.515	5.682	5.853
S	4.904	5.038	5.174	5.308	5.443	5.578	5.711	5.845
SW	5.336	5.429	5.523	5.616	5.711	5.806	5.900	5.995
W	5.702	5.771	5.841	5.910	5.980	6.050	6.120	6.190
NW	6.117	6.154	6.191	6.227	6.263	6.298	6.333	6.367
H	6.690	6.789	6.890	6.989	7.090	7.191	7.291	7.392

(continued)

TABLE 13-2C2.1.1C (continued)
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 7,8,9

SKYLIGHTS

Solar Heat Gain Coefficient	.481-.417	.416-.351	.350-.286	.285-.221	.22-.156	.155-.09	.89-.01
Summer	86.556	72.430	58.316	44.216	30.129	16.055	1.994
Winter	2.633	2.761	2.889	3.017	3.145	3.273	3.401

Double Pane: Default *U*-factor = 0.87								
Solar Heat Gain Coefficient	0.50-0.46	0.45-0.41	0.40-0.36	0.35-0.31	0.30-0.26	0.25-0.21	0.20-0.16	0.15-0
Summer:								
N	21.754	18.568	15.427	12.247	9.071	5.939	2.811	-0.396
NE	34.356	29.913	25.531	21.096	16.664	12.294	7.927	3.450
E	49.539	43.570	37.683	31.725	25.773	19.903	14.040	8.028
SE	50.314	44.270	38.310	32.277	26.249	20.305	14.365	8.275
S	41.877	36.684	31.564	26.381	21.202	16.096	10.994	5.762
SW	46.096	40.468	34.916	29.295	23.678	18.137	12.599	6.920
W	44.221	38.777	33.407	27.970	22.536	17.177	11.821	6.328
NW	29.645	25.663	21.737	17.762	13.790	9.874	5.961	1.948
H	82.992	71.977	61.113	50.114	39.123	28.282	17.449	6.338
Winter:								
N	4.484	4.517	4.548	4.579	4.610	4.640	4.669	4.698
NE	4.334	4.383	4.432	4.481	4.530	4.578	4.626	4.675
E	3.679	3.799	3.917	4.037	4.158	4.278	4.397	4.520
SE	3.350	3.502	3.654	3.809	3.966	4.123	4.281	4.445
S	3.529	3.658	3.785	3.913	4.041	4.167	4.293	4.421
SW	3.915	4.004	4.092	4.181	4.271	4.360	4.448	4.540
W	4.186	4.252	4.317	4.383	4.449	4.514	4.579	4.645
NW	4.463	4.497	4.530	4.564	4.596	4.628	4.659	4.691
H	4.797	4.896	4.995	5.094	5.194	5.292	5.391	5.492

13-C2.4 Ceilings.

13-2C2.4.1 Supplemental multipliers for ceilings under attics may be taken from Table 13-2C2.4.1

13-2C2.4.2 Supplemental multipliers for single assembly ceilings may be taken from Table 13-2C2.4.2.

13-2C2.4.3 Supplemental multipliers for concrete deck roofs with exposed ceilings may be taken from Table 13-2C2.4.3.

13-2C2.4.4 Supplemental multipliers for concrete roof decks with dropped ceilings may be taken from Table 13-2C2.4.4.

13-2C2.5 Floors.

13-2C2.5.1 Raised floors supported by stem walls with under floor insulation. Floor multipliers for stem walls with stem wall insulation shall be taken from Table 13-2C2.5.1.

13-2C2.5.1.1 Floor vent area.

1. In raised floors supported by stem walls with under floor insulation, the vent area for the subfloor space shall not exceed 1 square foot (.0929 m^2) per 150 square feet (14 m^2) of floor area.
2. In raised floors supported by stem walls with stem wall insulation, the vent area for the subfloor space

TABLE 13-2C2.2.1
CONCRETE BLOCK MULTIPLIERS – LIGHT WEIGHT

	ZONES 1,2,3				ZONES 4,5,6				ZONES 7,8,9			
	Interior Insulation		Exterior Insulation		Interior Insulation		Exterior Insulation		Interior Insulation		Exterior Insulation	
R-Value	SPM	WPM	SPM	WPM	SPM	WPM	SPM	WPM	SPM	WPM	SPM	WPM
0 - 2.9	1.7	8.8	1.7	8.8	1.8	4.7	1.8	4.7	3.3	1.5	3.3	1.5
3 - 4.9	1.0	6.1	0.7	4.9	1.1	3.1	0.8	2.3	2.2	0.9	1.5	0.5
5 - 6.9	0.8	4.8	0.4	3.9	0.8	2.4	0.3	1.7	1.6	0.7	1.1	0.3
7 - 10.9	0.6	4.0	0.2	3.1	0.6	1.9	0.1	1.2	1.3	0.5	0.7	0.2
11 - 18.9	0.4	2.8	0.1	2.2	0.3	1.3	0.0	0.8	0.9	0.3	0.4	0.0
19 - 25.9	0.2	1.8	—	—	0.1	0.8	—	0.5	0.2	—	—	—
26 & up	0.1	1.3	—	—	0.0	0.5	—	—	0.3	0.1	—	—

TABLE 13-2C2.2.2
CONCRETE BLOCK MULTIPLIERS POLYSTYRENE BEAD AGGREGATE

	Zones 1,2,3		Zones 4,5,6		Zones 7,8,9	
R-Value	SPM	WPM	SPM	WPM	SPM	WPM
0 & Up	0.8	5.3	0.6	2.4	2.0	0.6

TABLE 13-2C2.4.1
CEILING UNDER ATTIC SUMMER AND WINTER POINT MULTIPLIERS

North 1,2,3			Central 4,5,6			South 7,8,9		
R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points
R0	27.28	25.53	R0	10.81	30.53	R0	2.14	39.93
R5	7.44	6.80	R5	2.64	8.13	R5	0.46	10.67
R10	4.28	3.80	R10	1.46	4.60	R10	0.25	6.00
R15	3.19	2.80	R15	1.05	3.33	R15	0.18	4.40
R20	2.62	2.27	R20	0.84	2.73	R20	0.14	3.60
R25	2.28	1.93	R25	0.73	2.33	R25	0.11	3.13
R30	2.05	1.73	R30	0.64	2.13	R30	0.10	2.80
R35	1.89	1.60	R35	0.57	1.987	R35	0.09	2.53
R40	1.77	1.47	R40	0.52	1.80	R40	0.08	2.40
R45	1.66	1.40	R45	0.50	1.67	R45	0.07	2.20
R50	1.59	1.33	R50	0.48	1.60	R50	0.06	2.13

TABLE 13-2C2.4.2
CEILING SINGLE ASSEMBLY SUMMER AND WINTER POINT MULTIPLIERS

North 1,2,3			Central 4,5,6			South 7,8,9		
R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points
R0	16.50	41.20	R0	7.01	49.80	R0	1.21	65.50
R5	4.87	13.80	R5	1.87	16.80	R5	0.30	22.27
R10	2.87	8.40	R10	1.02	10.27	R10	0.16	13.67
R15	2.16	6.47	R15	0.75	7.93	R15	0.11	10.53
R20	1.80	5.47	R20	0.59	6.67	R20	0.10	8.87
R25	1.59	4.87	R25	0.52	5.93	R25	0.09	7.93
R30	1.43	4.40	R30	0.46	5.40	R30	0.08	7.27
R35	1.32	4.13	R35	0.41	5.07	R35	0.08	6.80
R40	1.25	3.87	R40	0.39	4.80	R40	0.08	6.40
R45	1.18	3.73	R45	0.36	4.60	R45	0.07	6.13
R50	1.14	3.60	R50	0.34	4.40	R50	0.07	6.27

TABLE 13-2C2.4.3
CONCRETE DECK ROOF: EXPOSED SUMMER AND WINTER POINT MULTIPLIERS

North 1,2,3			Central 4,5,6			South 7,8,9		
R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points
R0	23.28	54.20	R0	9.99	65.67	R0	1.82	86.67
R5	6.01	16.40	R5	2.30	20.00	R5	0.36	26.33
R10	3.16	9.13	R10	1.16	11.13	R10	0.18	14.73
R15	2.18	6.47	R15	0.77	7.93	R15	0.14	10.53
R20	1.66	5.13	R20	0.59	6.27	R20	0.09	8.33
R25	1.37	4.33	R25	0.48	5.27	R25	0.08	7.00
R30	1.16	3.80	R30	0.39	4.60	R30	0.07	6.13
R35	1.02	3.40	R35	0.34	4.13	R35	0.06	5.47
R40	0.91	3.07	R40	0.30	3.73	R40	0.05	5.00
R45	0.82	2.87	R45	0.25	3.47	R45	0.05	4.60
R50	0.75	2.67	R50	0.23	3.27	R50	0.05	4.33

shall not exceed $^1/_{10}$ square foot (.009 m^2) of open vent area per 150 square feet (14 m^2) of floor area when utilizing the stem wall with stem wall insulation multipliers. A continuous vapor barrier shall be applied over the ground under the floor.

13-2C3.0 Infiltration and internal gains.

13-2C3.1 Infiltration and internal gains multipliers. Infiltration and internal gains shall be considered the same for both the baseline and as-built conditions. Multipliers for infiltration and internal gains shall be determined from Table 6A-6 on Form 600A for the cooling load and from Table 6A-15 for the heating load.

13-2C4.0 Heating, ventilating and air conditioning.

13-2C4.1 General.

13-2C4.1.1 Multiple heating or cooling. Where two or more systems of the same type are installed with different levels of efficiency serving different parts of the house, a single system multiplier may be calculated. To select a multiplier for a dual system, the efficiency ratings for the two systems shall be combined based on the percentage of the total capacity supplied by each system. The new effective efficiency rating shall be calculated by Equation 13-2C4.1.1.

$$ER_{new} = \frac{(CR_a \times ER_a)}{CR_t} + \frac{(CR_b \times CR_b)}{CR_t}$$

(Equation 13-2C4.1.1)

Where:

ER_{new} = Efficiency to be used in selecting multiplier

CR_a = Capacity Rating of system A

TABLE 13-2C2.4.4
CONCRETE ROOF DECK: DROPPED SUMMER AND WINTER POINT MULTIPLIERS

North 1,2,3			Central 4,5,6			South 7,8,9		
R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points
R0	20.09	48.53	R0	8.26	58.00	R0	1.43	76.53
R5	5.42	15.0	R5	2.05	13.88	R5	0.32	24.13
R10	2.91	8.47	R10	1.05	10.40	R10	0.16	13.67
R15	2.00	6.07	R15	0.71	7.47	R15	0.11	9.87
R20	1.57	4.87	R20	0.57	6.20	R20	0.09	7.87
R25	1.30	4.07	R25	0.43	5.07	R25	0.07	6.67
R30	1.09	3.60	R30	0.36	4.47	R30	0.06	5.87
R35	0.98	3.27	R35	0.32	4.00	R35	0.05	5.27
R40	0.86	2.93	R40	0.27	3.67	R40	0.04	4.87
R45	0.80	2.73	R45	0.25	3.40	R45	0.04	4.47

TABLE 13-2C2.5.1
FLOORS MULTIPLIERS FOR STEM WALL WITH STEM WALL INSULATION

	ZONES 1,2,3		ZONES 4,5,6		ZONES 7,8,9	
R-Value	SPM	WPM	SPM	WPM	SPM	WPM
0	-4.7	3.5	-5.8	1.8	-4.2	0.3
3.5	-4.7	2.6	-5.8	1.4	-4.5	0.2
7	-4.7	2.4	-5.8	1.3	-4.6	0.2
11	-4.7	2.3	-5.8	1.3	-4.7	0.2

CR_b = Capacity Rating of system B

CR_t = Combined capacity of both systems

ER_a = Efficiency rating of system A

ER_b = Efficiency rating of system B

Where two or more dissimilar systems, such as electric and fuel-fired systems, are utilized, separate calculations shall be made for the separate zones of the structure serviced by each.

13-2C4.1.2 Existing systems. Multipliers for existing HVAC systems shall be taken from Table 13-2C4.1.2A or 13-2C4.1.2B based on the year the system was permitted unless documentation is available to demonstrate another efficiency.

TABLE 13-2C4.1.2A
COOLING SYSTEM MULTIPLIER ASSUMED MINIMUM RATINGS BY DATE PERMITTED
AIR CONDITIONERS

Date Building Permitted	Assumed Rating	Cooling System Multiplier (all zones)
Prior to 1979, average	EER 6.1	0.56
3/15/79 - 8/31/82	EER 6.1	0.56
9/1/82 - 5/31/84	EER 6.8	0.50
1/1/84 - 12/30/88	SEER 7.8	0.44
1/1/89 - 12/30/90	SEER 7.8	0.40
1/1/91 - 12/30/91	SEER 8.9	0.38
1/1/92 - 12/7/07	SEER 10.0	0.34
12/8/07 - present	SEER 13.0	0.26

TABLE 13-2C4.1.2B
HEATING SYSTEM MULTIPLIER ASSUMED MINIMUM RATINGS BY DATE PERMITTED HEAT PUMPS

Date Building Permitted	Assumed Rating	Heating System Multiplier		
		North	Central	South
Prior to 1979, average	COP 2.2	0.63	0.63	0.63
3/15/79 - 8/31/82	COP 2.2	0.63	0.63	0.63
9/1/82 - 5/31/84	COP 2.2	0.63	0.63	0.63
6/1/84 - 12/31/86	COP 2.5	0.56	0.54	0.53
1/1/87 - 12/30/90	COP 2.7	0.52	0.50	0.49
1/1/91 - 12/30/91	HSPF 6.8	0.53	0.53	0.53
1/1/92 - 12/7/07	HSPF 6.8	0.50	0.50	0.50
12/8/07 - present	HSPF 7.7	0.45	0.45	0.45

13-2C4.1.3 Interpolation of multipliers. Interpolation of multipliers for equipment efficiencies falling within ranges may be made in accordance with Section 13-2C1.2 of this appendix.

13-2C4.2 Cooling system. Multipliers shall be determined for air conditioners based on the appropriate efficiency rating for the system to be installed or from Table 6A-9 on Form 600A. Cooling system performance criteria and multipliers for systems not found on Form 600A may be found in Table 13-2C4.2. Interpolation of multipliers for equipment efficiencies falling within ranges may be made in accordance with Section 13-2C1.2 of this appendix.

13-2C4.2.1 Cooling system credits.

13-2C4.2.1.1 Ceiling fan credit. Ceiling fan credit may be taken if one or more ceiling fans are installed in each of the bedrooms and a minimum of one ceiling fan is installed in all primary living areas (living rooms, family rooms, or great rooms). This shall not include spaces designed to be dining rooms or dining areas. Areas separated by permanently fixed archways, walls, or dividers shall be considered separate rooms. The following criteria shall be met:

1. Ceiling fans shall be installed with minimum fan blade diameters of no less than those listed in Table 13-2C4.2.1.1 for the size and shape of the room.
2. Where a primary living area is an "L-shaped" room and the smaller portion of this area is 8 feet by 10 feet (2438 mm by 3048 mm) or larger, a fan shall be installed in both the larger and smaller portions of the primary living area.

Exception: Credit shall not be taken for both ceiling fans and cross ventilation.

TABLE 13-2C4.2.1.1
FAN SIZING TABLE

LONGEST WALL LENGTH (feet)	MINIMUM FAN SIZE (inches)
≤ 12	36
> 12 - 16	48
> 16 - 17.5	52
> 17.5 - 25	56
> 25	2 fans (minimum of 48 inches each)

For SI: 1 inch = 25.4, 1 foot = 304.8 mm.

13-2C4.2.1.2 Multizone practice. Multizone credit may be taken if two or more spaces (zones) are completely separated from one another by walls, ceilings, floor and totally closing doors and meet the following criteria:

1. A separate thermostatic control shall be provided for each zone which provides independent conditioning.
2. Zones shall be completely separated from one another by walls, ceilings, floor and totally closing doors and shall be configured such that air exchange between them does not exist in a free flow manner. Doors between zones shall not exceed a total of 40 square feet (4 m^2).

   Exceptions:

   a. Where one zone consists of multiple rooms which may be isolated with closeable doors and are served by one air conditioning system, separation criteria may be met by providing separate return air ducts to each room. The common space connecting the rooms shall be part of another zone.

TABLE 13-2C4.2
COOLING SYSTEM MULTIPLIERS GAS FUELED AIR CONDITIONERS

Natural Gas										
COP	.4–.49	.5–.59	.6–.69	.7–.79	.8–.89	.9–.99	1.0–1.09	1.1–1.19	1.2–1.29	1.3&Up
Zones 1,2,3	0.99	0.79	0.66	0.57	0.50	0.44	0.40	0.36	0.33	0.31
Zones 4,5,6	1.03	0.82	0.69	0.59	0.52	0.46	0.41	0.37	0.34	0.32
Zones 7,8,9	0.95	0.76	0.64	0.54	0.48	0.42	0.38	0.35	0.32	0.29

LP Gas										
COP	.4–.49	.5–.59	.6–.69	.7–.79	.8–.89	.9–.99	1.0–1.09	1.1–1.19	1.2–1.29	1.3&Up
Zones 1,2,3	1.35	1.08	0.90	0.77	0.67	0.60	0.54	0.49	0.45	0.41
Zones 4,5,6	1.26	1.01	0.84	0.72	0.63	0.56	0.50	0.46	0.42	0.39
Zones 7,8,9	1.21	0.97	0.81	0.69	0.61	0.54	0.49	0.44	0.40	0.37

b. Between lower and upper floors in a multiple-story home.

3. No zone shall constitute more than 75 percent of the total conditioned floor area.

The multizone credit multiplier shall be determined from Table 6A-19 on Form 600A.

13-2C4.2.1.3 Ventilation. Ventilation cooling credit may be taken for either cross ventilating a house or by installing a whole house fan, but credit shall not be taken for both. Cooling credit for ventilation shall be determined from Table 6A-19 on Form 600A.

13-2C4.2.1.3.1 Cross ventilation credit. Cross ventilation credit may be claimed where windows or doors are provided that meet the following criteria:

1. Operable aperture areas totaling a minimum of 12 percent of the floor area of the room shall be provided for all primary living areas and main bedrooms.
2. Insect screens shall be provided for all windows and doors to be considered operable aperture area. All screened entry doors and interior doors in the ventilated areas shall be provided with either (1) mechanically attached door stops (or similar devices) to hold the door in an open position or (2) operable louvers.
3. The total aperture area shall be provided by a minimum of two distinct windows. Each window shall provide not more than 70 percent of the total aperture area. The windows (or sliding glass doors) shall be placed in adjacent or opposite walls. The windows may be placed on a single outside wall if wing walls are used.
4. Where wing walls are included in the building design for ventilation purposes, they shall be placed between windows to create a high-pressure and a low-pressure zone on each window. Wing walls shall extend from the ground to eve height, be located on the windward side of the building, and extend outward from the building a distance at least equal to one-half the width of the window.

   NOTE: This technique is effective only for areas which experience significant and continuous winds during the cooling months.

13-2C4.2.1.3.2 Whole house fan credit. Whole house fan credit may be claimed where a whole house fan is installed and the following criteria are met:

1. The whole house fan has been sized to provide a minimum of 20 air changes per hour for the entire house.
2. The fan installed shall have a free air cfm rating of at least three times the square footage of the conditioned area of the house.
3. To ensure adequate air exhaust, the house attic shall have gable, ridge or wind turbine vents whose total opening area is equal to four times the ceiling cutout area for the whole house fan. Soffit vents shall not be included in the exhaust vent area.

13-2C4.2.1.4 Attic radiant barrier credit. Cooling credit may be taken for attic radiant barriers where a radiant barrier system is to be installed in one of the configurations depicted in Figure 13-2C4.2.1.4 and the following conditions are met:

1. It shall be fabricated over a ceiling insulated to a minimum of R-19 with conventional insulation. The radiant barrier credit shall not be used as a means to achieve partial or whole compliance with the minimum attic insulation level of R-19 prescribed in Section 13-604.ABC.1. Either a sheet type or spray applied interior radiation control coating (IRCC) may be used.
2. If the radiant barrier material has only one surface with high reflectivity or low emissivity it shall be facing downward toward the ceiling insulation.
3. The attic airspace shall be vented in accordance with Section 2309.7 of the *Florida Building Code, Building*.
4. The radiant barrier system shall conform to ASTM C 1313, *Standard Specification for Sheet Radiant Barriers for Building Construction Applications*, or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction* as appropriate for the type of radiant barrier to be installed. The operative surface shall have an emissivity not greater than 0.06 for sheet radiant barriers or 0.25 for interior radiation control coatings as demonstrated by independent laboratory testing according to ASTM C 1371.
5. The radiant barrier system (RBS) shall conform with ASTM C 1158, *Use and Installation of Radiant Barrier Systems (RBS) in Building Constructions for Sheet Radiant Barriers*, or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction* for IRCC systems.
6. The radiant barrier shall be installed so as to cover gable ends without closing off any soffit, gable or roof ventilation.

Cooling credit shall be taken against the ceiling load by multiplying the summer point multiplier for the ceiling configuraiton and insulation level chosen from Table 6A-4 on Form 600A by a credit multiplier of the following:

Sheet type radiant barriers:

0.70 (all climate zones)

Interior Radiation Control Coatings:

0.849 North Florida

0.864 Central Florida

0.865 South Florida

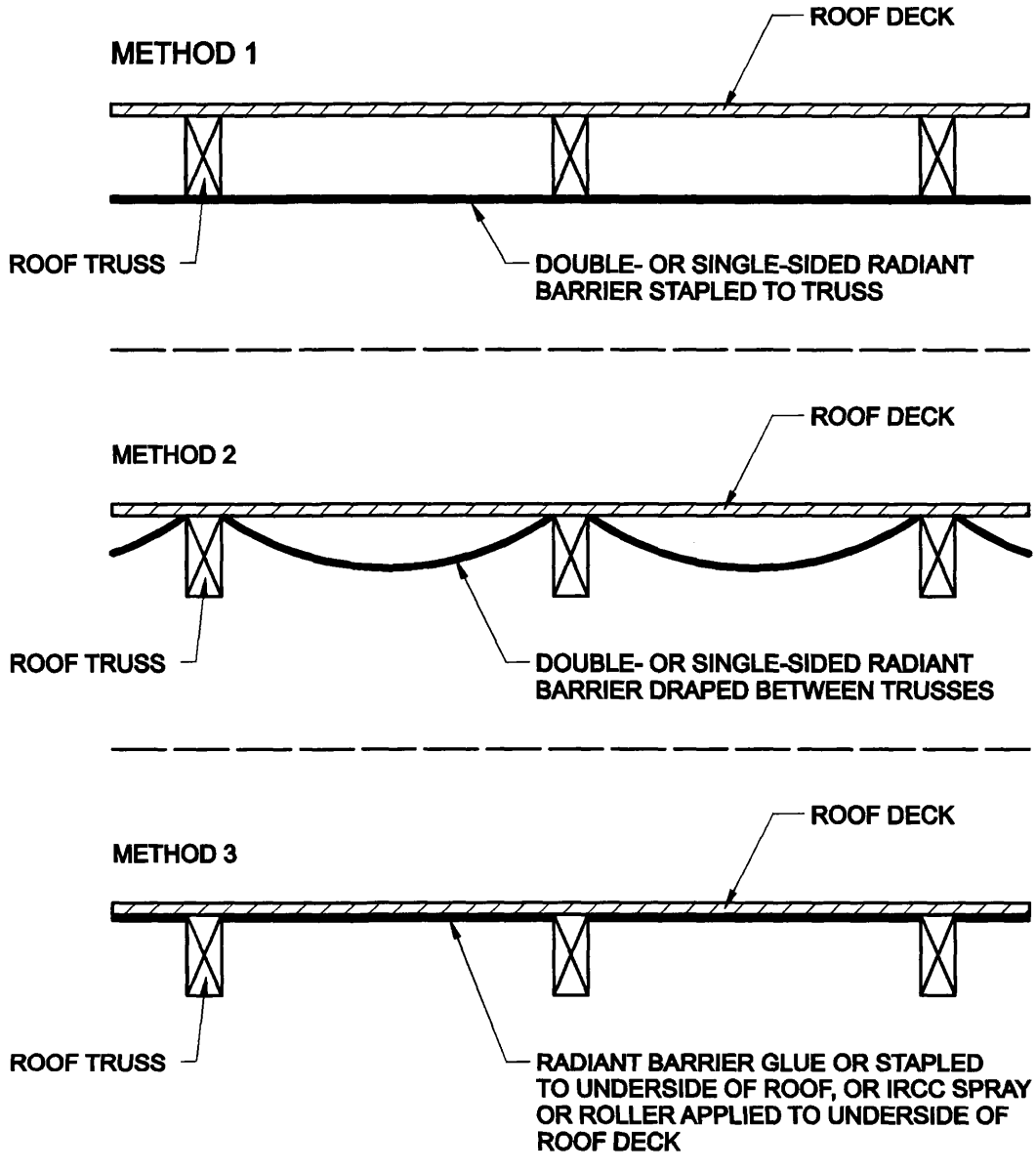


FIGURE 13-2C4.2.1.4
ACCEPTABLE ATTIC RADIANT BARRIER CONFIGURATIONS

13-2C4.2.1.5 Cool roof credit. Cool roof credit may be taken where a roof is installed that has a tested solar reflectance of greater than 4 percent when evaluated in accordance with ASTM E-903. Testing of a qualifying sample of the roofing material shall be performed by an approved independent laboratory with these results provided by the manufacturer.

Cooling credit shall be taken against the ceiling load by multiplying the summer point multiplier for the ceiling configuration and insulation level chosen on Form 600A by a credit multiplier according to the tested reflectance:

CM = 1.155 – 0.935 (Reflectance)

Where:

Reflectance = fractional (0–1)

Note that where a tested reflectance is not available the assumed roof reflectance will be 4 percent and a CM value of 1.118 will be used for those which are untested. This is also true for those roofs that do not use the cool roof credit.

13-2C4.2.1.6 Programmable thermostats. The cooling credit multiplier for programmable thermostats shall be determined from Table 6A-19 on Form 600A.

13-2C4.3 Heating systems. Multipliers shall be determined for the type of heating systems based on the appropriate efficiency rating for the system to be installed or from Table 6A-18 on Form 600A. Interpolation of multipliers for equipment efficiencies falling within ranges may be made in accordance with Section 13-2C1.2.

13-2C4.3.1 Heating system credits. Heating credit multipliers (HCM) are given for certain technologies which reduce energy use or cost. Heating credit may be taken for the options in this section where the criteria of 13-2C4.3.1.1 through 13-2C4.3.1.5 have been met for that option. Where more than one heating credit is taken, the multipliers for each option shall be multiplied together to obtain one multiplier.

13-2C4.3.1.1 Attic radiant barriers. Attic radiant barrier credit may be taken when an attic radiant barrier is installed that is compliant with all requirements in Section 13-2C4.2.1.4. Heating credit shall be taken against the ceiling load by multiplying the winter point multiplier for the ceiling configuration and insulation level chosen from Table 6A-13 on Form 600A by a credit multiplier of the following:

Sheet type radiant barriers	0.85 (all climate zones)
Interior radiation control coatings	0.912 North Florida
	0.905 Central Florida
	0.899 South Florida

13-2C4.3.1.2 Multizone practice. Multizone credit may be taken where two or more independent heating zones occur in a building that meets the prescriptive construction requirements in Section 13-2C4.1.2. The heating credit multiplier for multizone systems shall be determined from Table 6A-18 on Form 600A.

13-2C4.3.1.3 Hydronic space water heating. Hydronic space gas heating credit multipliers may be used for houses where hydronic space gas water heating systems are installed where the effective space heating efficiency (CA_{afue}) of the system (as listed by GAMA) has not been tested to ANSI/ASHRAE 124. Combined gas instantaneous (tankless) water heating and space heating systems may be rated based on the Thermal Efficiency (Et) rating of the gas instantaneous (tankless water heater in accordance with ANSI test method Z21.10.3. The heating system credit multiplier for combined hydronic space gas water heating with a storage tank shall be taken from Table 13-2C4.3.1.3A. The heating system credit multiplier for combined hydronic instantaneous (tankless) gas water heating shall be taken from Table 13-2C4.3.1.3B. A gas instantaneous (tankless) water heater shall be as defined in Section 13-612.ABC.3.2.3.

TABLE 13-2C4.3.1.3A
HEATING SYSTEM CREDIT MULTIPLIERS FOR COMBINED HYDRONIC SPACE GAS WATER HEATING WITH A STORAGE TANK

Gas Water Heater Recovery Efficiency	Zones 1,2,3	Zones 4,5,6	Zones 7,8,9
0.76	0.54	0.56	0.52
0.83	0.49	0.51	0.47
0.94	0.44	0.45	0.42

TABLE 13-2C4.3.1.3B
HEATING SYSTEM CREDIT MULTIPLIERS FOR COMBINED HYDRONIC INSTANTANEOUS (TANKLESS) GAS WATER HEATING

Tankless Water Heater Thermal Efficiency (E_t)	Zones 1,2,3	Zones 4,5,6	Zones 7,8,9
.78	.52	.55	.57
.80	.51	.54	.57
.84 and up	.49	.52	.56

13-2C4.3.1.4 Programmable thermostats. Programmable thermostat credit may be claimed for houses installed with programmable thermostats that are capable of being set as follows:

Winter: 68°F (20°C) from 6 am - 11 pm
66°F (19°C) from 11 pm - 6 am

Houses for which programmable thermostat credit is claimed shall have one or more features on the thermostat that prevent supplemental heat from being automatically engaged. The heating credit multiplier for programmable thermostats shall be determined from Table 6A-21 on Form 600A.

13-2C4.3.1.5 Cool roofs. Cool roof credit may be claimed for houses when a cool roof system is installed that is compliant with all requirements in Section 13-2C4.2.1.5. Heating credit shall be taken against the ceiling load by multiplying the winter point multiplier for the ceiling configuration and insulation level chosen on Form 600A by a credit multiplier. Credit shall not be taken for both attic radiant barrier and cool roofs in conjunction.

HM = 0.987 + 0.088 (Reflectance)

Note that where a tested reflectance is not available the assumed roof reflectance will be 4 percent and a HM value of 0.987 will be used for those which are untested. This is also true for those roofs that do not use the cool roof credit.

13-2C4.3.2 Other gas systems.

13-2C4.3.2.1 Gas fueled heat pumps. Heating system multipliers for gas-fueled air conditioners and heat pumps shall be taken from Table 13-2C4.3.2.1.

13-2C4.3.2.2 Combination gas hydronic systems; hydronic space water heating. Hydronic space gas heating multipliers may be used for houses where hydronic space gas water heating systems are installed in accordance with the following criteria:

1. Combined gas storage tank water heating and space heating systems that have been tested to ANSI/ASHRAE 124 may be rated based on the effective space heating efficiency (CA_{afue}) as listed by the GAMA, or
2. Combined gas instantaneous (tankless) water heating and space heating systems may be rated based on the Thermal Efficiency (E_t) rating of the gas instantaneous (tankless) water heater in accordance with ANSI test method Z21.10.3.

Heating system multipliers to be used for combined gas storage tank water heating and space heating systems may be determined from Table 6A-18 on Form 600A based on the effective space heating efficiency (CA_{afue}) as listed by GAMA where the system has been tested to ANSI/ASHRAE 124.

13-2C5.0 Air distribution systems.

13-2C5.1 General.

13-2C5.1.1 Ducts in conditioned space. For ductwork to qualify as being in conditioned space, it shall be located on the conditioned side of the envelope insulation and be situated in such a manner that any air leakage will be discharged into the conditioned space. Systems having no return air ducts or plenums between the air intake and the air handler, such as those in mechanical closets which communicate with the conditioned space, shall be considered systems with return ducts in conditioned space.

13-2C5.1.2 Multiple duct systems. Where parts of the structure are to be served by ductwork of different *R*-values, or by ducts in conditioned space, the duct calculation shall be performed by one of the following methods.

1. The smallest *R*-value may be used.
2. Each of the different *R*-values may be multiplied by the total duct area that has this insulation rating. The results are then summed and divided by the total area of the ductwork.

13-2C5.1.3 Additions. If ducts are added to supply conditioned air to the addition, the ducts shall meet or exceed the minimum *R*-value requirements of this code. If conditioning is provided by existing ducts and registers or diffusers, a baseline duct shall be assumed.

13-2C5.2 Air distribution system multipliers.

13-2C5.2.1 Duct multipliers. Multipliers for the type of duct system and insulation level to be installed shall be determined from Tables 6A-7 and 6A-16 on Form 600A. Multipliers for duct conditions not found on Form 600A may be found in Tables 13-2C5.2.1A through 13-2C5.2.1C for the climate zone where they are to be installed.

13-2C5.2.1.1 Duct length determination. An estimate of the linear footage of duct shall be utilized on Form 600A.

13-2C5.2.2 Air-handling unit multipliers. Air-handling multipliers shall be determined from Tables 6A-7 and 6A-16 on Form 600A by the location of the air handler in the building for summer and winter conditions.

13-2C5.2.2.1 Air distribution system credits. Credits are given for air distribution system practices described in Sections C5.2.2.1.1 and C5.2.2.1.2. AHU credit multipliers shall be entered into the as-built AHU boxes on Form 600A and calculated as part of the cooling and heating loads for the building.

13-2C5.2.2.1.1 Air-tight duct credit. An air-tight duct credit multiplier of 1.0 may be taken if the duct work has been demonstrated to be "substantially leak free". "Substantially leak free" shall mean distribution system air leakage to outdoors no greater than 3 cfm per 100 square feet of conditioned floor area and distribution system total air leakage to indoors and outdoors no greater than 9 cfm per 100 square feet of conditioned floor area at a pressure differential of 25 Pascal (0.10 in. w.c.) across the entire air distribution system, including the manufacturer's air handler enclosure. Distribution system total air leakage no greater than 3 cfm per 100 square feet of conditioned floor area at a pressure difference of 25 Pascal across the entire system, including the manufacturer's air handler enclosure, shall be deemed to meet this re-

TABLE 13-2C4.3.2.1
HEATING SYSTEM MULTIPLIERS GAS FUELED HEAT PUMPS

	Natural Gas		LP Gas	
COP	1.25	1.30	1.25	1.30
Climate Zones 1,2,3	0.32	0.31	0.43	0.41
Climate Zones 4,5,6	0.33	0.32	0.40	0.39
Climate Zones 7,8,9	0.30	0.29	0.39	0.37

TABLE 13-2C5.2.1A
DUCT MULTIPLIERS NORTH FLORIDA

Supply duct location	Duct R-value	Return Duct Location					
		Unconditioned		Attic w/RBS		Attic w/white roof	
		WDM	SDM	WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.497	1.382	1.454	1.382	1.480	1.384
	2.0	1.164	1.189	1.150	1.180	1.157	1.180
	4.2	1.093	1.118	1.086	1.111	1.089	1.111
	6.0	1.069	1.090	1.064	1.084	1.066	1.084
	8.0	1.053	1.071	1.049	1.066	1.051	1.066
	10.0	1.044	1.059	1.041	1.055	1.042	1.054
Attic w/RBS	0.0	1.237	1.222	1.197	1.190	—	—
	2.0	1.107	1.113	1.093	1.102	—	—
	4.2	1.067	1.072	1.059	1.066	—	—
	6.0	1.051	1.056	1.045	1.051	—	—
	8.0	1.040	1.045	1.036	1.041	—	—
	10.0	1.034	1.037	1.030	1.034	—	—
Attic w/white roof	0.0	1.552	1.256	—	—	1.512	1.224
	2.0	1.182	1.113	—	—	1.169	1.102
	4.2	1.104	1.068	—	—	1.096	1.062
	6.0	1.076	1.051	—	—	1.071	1.047
	8.0	1.059	1.040	—	—	1.055	1.036
	10.0	1.049	1.033	—	—	1.045	1.030
Attic w/ IRCC	0.0	1.406	1.289	—	—	—	—
	2.0	1.161	1.153	—	—	—	—
	4.2	1.096	1.099	—	—	—	—
	6.0	1.072	1.076	—	—	—	—
	8.0	1.056	1.061	—	—	—	—
	10.0	1.047	1.051	—	—	—	—
Conditioned space	0.0	1.040	1.032	1.029	1.021	1.040	1.014
	2.0	1.014	1.011	1.012	1.009	1.014	1.005
	4.2	1.008	1.006	1.007	1.005	1.008	1.003
	6.0	1.006	1.005	1.005	1.004	1.006	1.002
	8.0	1.005	1.004	1.004	1.003	1.005	1.002
	10.0	1.004	1.003	1.003	1.003	1.004	1.001

(continued)

TABLE 13-2C5.2.1A - continued
DUCT MULTIPLIERS NORTH FLORIDA

Supply duct location	Duct R-value	Return Duct Location			
		Attic w/ IRCC		Conditioned Space	
		WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.468	1.387	1.438	1.366
	2.0	1.155	1.182	1.143	1.174
	4.2	1.088	1.112	1.081	1.107
	6.0	1.065	1.085	1.060	1.081
	8.0	1.051	1.067	1.046	1.064
	10.0	1.042	1.055	1.038	1.053
Attic w/RBS	0.0	—	—	1.180	1.185
	2.0	—	—	1.083	1.095
	4.2	—	—	1.052	1.061
	6.0	—	—	1.040	1.047
	8.0	—	—	1.032	1.037
	10.0	—	—	1.026	1.031
Attic w/white roof	0.0	—	—	1.452	1.219
	2.0	—	—	1.147	1.096
	4.2	—	—	1.083	1.057
	6.0	—	—	1.061	1.043
	8.0	—	—	1.048	1.034
	10.0	—	—	1.039	1.028
Attic w/ IRCC	0.0	1.366	1.257	1.327	1.248
	2.0	1.148	1.141	1.129	1.132
	4.2	1.088	1.092	1.077	1.084
	6.0	1.066	1.071	1.057	1.065
	8.0	1.052	1.057	1.045	1.052
	10.0	1.043	1.048	1.037	1.043
Conditioned space	0.0	1.042	1.029	1.000	1.000
	2.0	1.016	1.011	1.000	1.000
	4.2	1.010	1.007	1.000	1.000
	6.0	1.007	1.005	1.000	1.000
	8.0	1.006	1.004	1.000	1.000
	10.0	1.005	1.003	1.000	1.000

TABLE 13-2C5.2.1B
DUCT MULTIPLIERS CENTRAL FLORIDA

Supply duct location	Duct R-value	Return Duct Location					
		Unconditioned		Attic w/RBS		Attic w/white roof	
		WDM	SDM	WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.589	1.334	1.536	1.339	1.566	1.342
	2.0	1.190	1.176	1.173	1.169	1.180	1.169
	4.2	1.107	1.113	1.098	1.107	1.102	1.107
	6.0	1.078	1.087	1.072	1.081	1.075	1.081
	8.0	1.061	1.069	1.056	1.064	1.058	1.064
	10.0	1.050	1.057	1.046	1.054	1.048	1.053
Attic w/RBS	0.0	1.277	1.212	1.230	1.181	—	—
	2.0	1.123	1.111	1.107	1.100	—	—
	4.2	1.076	1.072	1.067	1.066	—	—
	6.0	1.058	1.056	1.051	1.051	—	—
	8.0	1.046	1.045	1.041	1.041	—	—
	10.0	1.038	1.038	1.034	1.034	—	—
Attic w/white roof	0.0	1.661	1.246	—	—	1.614	1.214
	2.0	1.213	1.113	—	—	1.197	1.102
	4.2	1.119	1.069	—	—	1.110	1.063
	6.0	1.088	1.052	—	—	1.081	1.047
	8.0	1.068	1.041	—	—	1.063	1.037
	10.0	1.056	1.034	—	—	1.051	1.031
Attic w/ IRCC	0.0	1.413	1.288	—	—	—	—
	2.0	1.164	1.152	—	—	—	—
	4.2	1.097	1.098	—	—	—	—
	6.0	1.073	1.076	—	—	—	—
	8.0	1.057	1.060	—	—	—	—
	10.0	1.047	1.051	—	—	—	—
Conditioned space	0.0	1.047	1.031	1.034	1.02	1.047	1.014
	2.0	1.016	1.011	1.014	1.00	1.016	1.005
	4.2	1.009	1.006	1.008	1.00	1.009	1.003
	6.0	1.007	1.005	1.006	1.00	1.007	1.002
	8.0	1.005	1.004	1.005	1.00	1.005	1.002
	10.0	1.004	1.003	1.004	1.00	1.004	1.001

(continued)

TABLE 13-2C5.2.1B - continued
DUCT MULTIPLIERS CENTRAL FLORIDA

Supply duct location	Duct R-value	Return Duct Location			
		Attic w/ IRCC		Conditioned Space	
		WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.546	1.346	1.517	1.322
	2.0	1.176	1.172	1.164	1.163
	4.2	1.100	1.108	1.092	1.103
	6.0	1.074	1.083	1.068	1.079
	8.0	1.057	1.065	1.052	1.062
	10.0	1.047	1.054	1.043	1.052
Attic w/RBS	0.0	—	—	1.209	1.177
	2.0	—	—	1.095	1.094
	4.2	—	—	1.059	1.061
	6.0	—	—	1.045	1.047
	8.0	—	—	1.036	1.041
	10.0	—	—	1.030	1.032
Attic w/white roof	0.0	—	—	1.540	1.211
	2.0	—	—	1.170	1.096
	4.2	—	—	1.095	1.058
	6.0	—	—	1.070	1.044
	8.0	—	—	1.054	1.034
	10.0	—	—	1.045	1.028
Attic w/ IRCC	0.0	1.366	1.257	1.327	1.248
	2.0	1.148	1.141	1.129	1.132
	4.2	1.088	1.092	1.077	1.084
	6.0	1.066	1.071	1.057	1.065
	8.0	1.052	1.057	1.045	1.052
	10.0	1.043	10.48	1.037	1.043
Conditioned space	0.0	1.042	1.029	1.000	1.000
	2.0	1.016	1.011	1.000	1.000
	4.2	1.010	1.007	1.000	1.000
	6.0	1.007	1.005	1.000	1.000
	8.0	1.006	1.004	1.000	1.000
	10.0	1.005	1.003	1.000	1.000

TABLE 13-2C5.2.1C
DUCT MULTIPLIERS SOUTH FLORIDA

Supply duct location	Duct R-value	Return Duct Location					
		Unconditioned		Attic w/RBS		Attic w/white roof	
		WDM	SDM	WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.765	1.296	1.694	1.299	1.734	1.302
	2.0	1.244	1.150	1.220	1.144	1.229	1.144
	4.2	1.135	1.095	1.123	1.090	1.128	1.090
	6.0	1.099	1.073	1.091	1.069	1.094	1.069
	8.0	1.076	1.058	1.070	1.055	1.073	1.055
	10.0	1.063	1.049	1.058	1.046	1.060	1.046
Attic w/RBS	0.0	1.349	1.178	1.289	1.153	—	—
	2.0	1.154	1.094	1.134	1.085	—	—
	4.2	1.095	1.062	1.083	1.057	—	—
	6.0	1.072	1.048	1.063	1.044	—	—
	8.0	1.057	1.039	1.050	1.036	—	—
	10.0	1.048	1.032	1.042	1.030	—	—
Attic w/white roof	0.0	1.860	1.205	—	—	1.800	1.180
	2.0	1.273	1.095	—	—	1.252	1.086
	4.2	1.151	1.059	—	—	1.139	1.054
	6.0	1.111	1.045	—	—	1.102	1.041
	8.0	1.085	1.035	—	—	1.078	1.032
	10.0	1.070	1.029	—	—	1.064	1.027
Attic w/ IRCC	0.0	1.531	1.249	—	—	—	—
	2.0	1.207	1.128	—	—	—	—
	4.2	1.122	1.083	—	—	—	—
	6.0	1.091	1.064	—	—	—	—
	8.0	1.071	1.052	—	—	—	—
	10.0	1.059	1.043	—	—	—	—
Conditioned space	0.0	1.060	1.025	1.043	1.017	1.060	1.011
	2.0	1.020	1.009	1.017	1.007	1.020	1.004
	4.2	1.012	1.005	1.010	1.004	1.012	1.002
	6.0	1.009	1.004	1.008	1.003	1.009	1.002
	8.0	1.007	1.003	1.006	1.003	1.007	1.001
	10.0	1.006	1.003	1.005	1.002	1.006	1.001

(continued)

TABLE 13-2C5.2.1C - continued
DUCT MULTIPLIERS SOUTH FLORIDA

Supply duct location	Duct R-value	Return Duct Location			
		Attic w/ IRCC		Conditioned Space	
		WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.708	1.305	1.671	1.286
	2.0	1.224	1.146	1.209	1.139
	4.2	1.125	1.091	1.116	1.087
	6.0	1.092	1.070	1.085	1.067
	8.0	1.071	1.055	1.066	1.053
	10.0	1.059	1.046	1.054	1.044
Attic w/RBS	0.0	—	—	1.262	1.150
	2.0	—	—	1.118	1.081
	4.2	—	—	1.073	1.053
	6.0	—	—	1.056	1.041
	8.0	—	—	1.044	1.033
	10.0	—	—	1.037	1.028
Attic w/white roof	0.0	—	—	1.702	1.178
	2.0	—	—	1.216	1.082
	4.2	—	—	1.120	1.051
	6.0	—	—	1.088	1.038
	8.0	—	—	1.068	1.030
	10.0	—	—	1.056	1.025
Attic w/ IRCC	0.0	1.471	1.224	1.149	1.217
	2.0	1.187	1.119	1.162	1.111
	4.2	1.110	1.078	1.096	1.072
	6.0	1.083	1.061	1.072	1.056
	8.0	1.065	1.049	1.056	1.045
	10.0	1.054	1.041	1.046	1.037
Conditioned space	0.0	1.054	1.024	1.000	1.000
	2.0	1.020	1.009	1.000	1.000
	4.2	1.012	1.006	1.000	1.000
	6.0	1.009	1.004	1.000	1.000
	8.0	1.007	1.003	1.000	1.000
	10.0	1.006	1.003	1.000	1.000

quirement without measurement of distribution system air leakage to outdoors. Substantially leak free air distribution systems shall be certified by means of a test report prepared by a state-approved performance tester. A state-approved performance tester means a Class 1 Florida Energy Gauge Certified Energy Rater, State of Florida mechanical contractor or recognized test and balance agent. Contractors shall not test their own systems.

13-2C5.2.2.1.2 Factory-sealed air-handling unit credit. A factory-sealed air-handling unit credit multiplier of 0.95 may be claimed if the unit has been tested and certified by the manufacturer to have achieved a 2 percent or less leakage rate at 1-inch water gauge when all air inlets, air outlets and condensate drain port(s), when present, are sealed at an air pressure of 1-inch water gauge with no greater than 2-percent design cubic foot per minute discharge.

13-2C6.0 Service hot water.

13-2C6.1 General.

13-2C6.1.1 Water heater area determination. Water heating requirements are estimated based on the number of bedrooms in the residence. Any room which has an area of 70 square feet (7 m^2) or more and a clothes storage closet, and is not part of the common living area, shall be considered a bedroom for calculation purposes.

13-2C6.1.2 Multiple water heating systems. Where two or more water heating systems are installed with different levels of efficiency, a single multiplier shall be calculated for determining compliance with this code as per the Equation 13-2C4.1.1 in Section 13-2C4.1.1 of this appendix.

13-2C6.2 Water heater types and multipliers. Hot water multipliers for the water heating system to be installed shall be determined from Table 6A-22 on Form 600A based on the EF of the system.

13-2C6.2.1 Gas instantaneous (tankless) water heater multipliers. Multipliers for gas instantaneous (tankless) water heaters shall be taken from Table 13-2C6.2.1.

13-2C6.2.2 Water heater credit multipliers. Hot water credit multipliers (HWCM) may be taken if supplemental water heating systems or alternate systems are installed which meet the criteria in Sections 13-2C6.2.2.1 through 13-2C6.2.2.4. Electric resistance or natural gas water heating systems may be installed as backup to alternate water heating systems. HWCM shall be determined from Table 6A-23 on Form 600A for the alternate water heating system installed. Both a hot water multiplier (HWM) and a credit multiplier (HWCM) shall be used in the hot water calculation.

Electric resistance or natural gas water heating systems may be installed as backup to alternate water heating systems.

13-2C6.2.2.1 Waste heat recovery unit. Credit may be claimed for installation of a waste heat recovery unit (HRU) on either an air conditioner or a heat pump where the heat recovery unit meets all the criteria for this section. Credit multipliers shall be determined from Table 6A-23 on Form 600A based on the type of system to which the HRU is attached.

1. To obtain credits under the code, a storage water heater which meets the minimum performance criteria of Section 13-612.ABC shall be used in conjunction with the HRU. This water heater shall provide service hot water to the water circuit with the most fixtures in the residence and shall be sized as follows.
   a. Two bedroom and up, single-family 50 gallon (189 L) tank minimum.

TABLE 13-2C6.2.1
GAS INSTANTANEOUS (TANKLESS) WATER HEATER MULTIPLIERS

CLIMATE ZONE 123	HOT WATER MULTIPLIERS (HWM)													
EF	.60-.61	.62-.63	.64-.65	.66-.67	.68-.69	.70-.71	.72-.73	.74-.75	.76-.77	.78-.79	.80-.81	.82-.83	.84-.85	0.86 & Up
Natural Gas HWM	1599	1547	1498	1453	1412	1375	1341	1309	1279	1252	1226	1202	1179	1157
Propane Gas HWM	2171	2101	2035	1973	1920	1869	1821	1776	1735	1696	1660	1626	1594	1564
CLIMATE ZONE 456														
EF	.60-.61	.62-.63	.64-.65	.66-.67	.68-.69	.70-.71	.72-.73	.74-.75	.76-.77	.78-.79	.80-.81	.82-.83	.84-.85	0.86 & Up
Natural Gas HWM	1549	1499	1452	1408	1367	1328	1293	1261	1231	1205	1183	1164	1148	1137
Propane Gas HWM	1895	1834	1776	1722	1676	1631	1588	1549	1513	1478	1446	1417	1389	1362
CLIMATE ZONE 789														
EF	.60-.61	.62-.63	.64-.65	.66-.67	.68-.69	.70-.71	.72-.73	.74-.75	.76-.77	.78-.79	.80-.81	.82-.83	.84-.85	0.86 & Up
Natural Gas HWM	1324	1281	1241	1203	1167	1134	1103	1073	1046	1020	997	975	956	938
Propane Gas HWM	1686	1631	1581	1533	1492	1452	1415	1380	1348	1318	1290	1264	1239	1216

b. Two bedroom and up, multiple-family, and one bedroom single-family 40 gallon (151 L) tank minimum.

c. One bedroom multiple-family 30 gallon (114 L) tank minimum.

2. To obtain credit, a heat recovery unit shall be tested by an independent testing laboratory under the standard rating conditions specified in Florida Standard FL-1 (see Appendix 13-E) and shall have a minimum net useful heat exchange effect of 50 percent. A copy of Form 600D (see Appendix 13-D) shall be prominently displayed on the heat recovery unit, with test results clearly visible for inspection through a transparent, weatherproof envelope. An ARDM-certified refrigerant desuperheater seal affixed to the unit, clearly visible for inspection, may be substituted for the 600D form. This seal indicates that the unit meets the criteria of this section.

3. Multiple HRUs on multiple air conditioners are allowed. If more than one air-conditioning system is installed in a residence and only one HRU is installed, the HRU shall be attached to the system serving the daytime primary living areas (family room, living room, kitchen, dining room and adjacent bedrooms and bathrooms) to obtain credit. If the HRU is installed in a residence which has only one water heater, the entire HRU credit may be claimed. If more than one water heater is installed in the residence, credit may be claimed based on the gallon capacity of the water heater to which it is coupled and the total capacity of the water heaters in the residence by entering a calculation for each water heating system as follows:

$$\text{Total \# Bedrooms} \times \frac{\text{Gallons with HRU}}{\text{Total Gallons}} \times \text{HWCM} \times \text{HWM} = \text{Hot Water Points, System \#1}$$

$$\text{Total \# Bedrooms} \times \frac{\text{Gallons without HRU}}{\text{Total Gallons}} \times 1 \times \text{HWM} = \text{Hot Water Points, System \#2}$$

Equals = Total Hot Water Points

13-2C6.2.2.2 Dedicated heat pump. Credit may be claimed for installation for installation of a dedicated heat pump, either as an add-on to a conventional water heater or as a separate integral system. The credit multiplier shall be determined from Table 6A-23 on Form 600A based on the EF of the system installed.

13-2C6.2.2.3 Integrated heat pumps. Credit may be claimed for installation of an integrated heat pump, either as an add-on to a conventional water heater or as a separate integral system. The credit multiplier shall be determined from Table 6A-23 on Form 600A based on the combined cooling performance factor (CCPF) and the combined heating performance factor (CHPF) of the system installed. An equivalent dedicated heat pump EF shall be calculated according to Equation 13-2C6.2.2.3 where the various terms are defined in ASHRAE 137 and the DOE waiver granted to NORDYNE and published in the Federal Register Vol. 61, No. 55, Wednesday, March 20, 1996, pages 11395-11400.

$$EF = \frac{\frac{q_w}{EF_{sep}}}{\frac{q_o\,(95).CLH + q_{wos}}{CCPF} + \frac{DHR.HLH.C + q_{whs}}{CHPF} - \frac{q_c\,(95).CLH}{SEER} - \frac{DHR.HLH.C}{HSPF}}$$

13-2C6.2.2.4 Solar water heater. Credit may be claimed for installation of a solar water heater, either as an add-on to a conventional water heater or as a separate system (with tank). The credit multiplier for an add-on solar system (without tank) shall be determined from Table 6A-23 on Form 600A based on the EF of the system installed.

APPENDIX 13-D

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

SUBCHAPTER 4 – Commercial Building Compliance Methods

Form 400C-07
Building Prescriptive Envelope Method

ASHRAE
Climate Zone 2

Project Name:	Zone:
Address:	Building Classification:
City, Zip Code:	Building Permit No.:
Builder:	Permitting Office:
Owner:	Jurisdiction No.:

BUILDING ENVELOPE INFORMATION

ENVELOPE COMPONENT	Nonresidential		Residential		Semiheated	
	U-factor	*R*-value	*U*-factor	*R*-value	*U*-factor	*R*-value
Roof type:						
Wall type:						
Floor type:						
Fenestration	Max. *U*-factor Fixed/operable	Max. SHGC All orientation	Max. *U*-factor Fixed/operable	Max. SHGC All orientation	Max. *U*-factor Fixed/operable	Max. SHGC All orientation
Vertical glazing type, % of wall:						
Skylight type, % of roof:						

SYSTEMS INFORMATION

SYSTEM	Type (describe system)			Size (capacity)	Sizing calc.	Efficiency	Rating
Air-conditioning system							
Heating system							
Ventilation							
Ducts	Location:			Fan Power:		*R*-value	
Piping	Fluid design operating temp:			Size of pipe:	-------	Inches	
Hot water					-------	EF	
Electric power	Drawings	Y	N	Operations manual available upon completion:	Y	N	
Motors	Open or enclosed			Poles & speed		Horsepower:	
Lighting	Space type:			Lighting power density			

PRESCRIPTIVE MEASURES

Components	Section	Requirements	Check
Operations Manual	13-102.1, 13-410, 13-413	Operations manual provided to owner.	
Windows & Doors	13-406.ABC.1.1	Glazed swinging entrance & revolving doors: max. 1.0 cfm/ft^2; all other products: 0.4 cfm/ft^2.	
Joints/Cracks	13-406.ABC.1.2	To be caulked, gasketed, weatherstripped or otherwise sealed.	
Dropped Ceiling Cavity	13-406.ABC.1.4	Vented: seal & insulated ceiling. Unvented seal & insulate roof & side walls.	
Reheat	13-407.BC	Electric resistance reheat prohibited.	
HVAC Efficiency	13-407, 13-408	Minimum efficiencies: Cooling Tables 13-407.ABC.3.2A-D; Heating Tables 13-407.ABC.3.2B, 13-407.ABC.3.2D, 13-408.ABC.3.2E thru 13-408.ABC.3.2G.	
HVAC Controls	13-407.ABC.2	Zone controls prevent reheat (exceptions); separate thermostatic control per zone; combined HAC control 5°F deadband (exceptions).	
Ventilation	13-409.ABC.3	Motorized dampers reqd. except gravity dampers OK in: 1) exhaust systems and 2) systems with design outside air intake or exhaust capacity ≤300 cfm.	
HVAC Ducts	13-410.ABC	Air ducts, fittings, mechanical equipment & plenum chambers shall be mechanically attached, sealed, insulated & installed per Sec. 13-410.ABC. Fan power limitations.	
Balancing	13-410.ABC.4	HVAC distribution system(s) tested & balanced. Report in construction documents.	
Piping Insulation	13-411.ABC	In accordance with Table 13-411.ABC.2.	
Water Heaters	13-412.ABC	Performance requirements in accordance with Table 13-412.ABC.3. Heat trap required.	
Swimming Pools	13-412.ABC.2.6	Cover on heated pools; Time switch (exceptions); Readily accessible on/off switch.	
Hot Water Pipe Insulation	13-412.ABC.4	Table 13-411.ABC.2 for circulating systems, first 8' outlet pipe from storage tank, between inlet pipe and heat trap.	
Water Fixtures	13-412.ABC.2.5.2	Shower heat water flow restricted to 2.5 gpm at 80 psi. Public lavatory fixture max. Flow 0.5 gpm; if self-closing valve 0.25 gallon circulating, 0.5 gallon noncirculating.	
Lighting Controls	13-415.ABC	Automatic control required for interior lighting in buildings <5,000 s.f.; Space control; Exterior photo sensor; Tandem wiring where 1-3 linear fluorescent lamps >30W.	

If required by Florida law, I hereby certify that the system design is in compliance with the Florida Energy Code. Registration number
ARCHITECT: _____
ELECTRICAL SYSTEM DESIGNER: _____
LIGHTING SYSTEM DESIGNER: _____
MECHANICAL SYSTEM DESIGNER: _____
PLUMBING SYSTEM DESIGNER: _____

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.
PREPARED BY: _____ DATE: _____
I hereby certify that this building is in compliance with the Florida Energy Code:
OWNER AGENT: _____ DATE: _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.
BUILDING OFFICIAL: _____
DATE: _____

Form 400C-07
Building Prescriptive Envelope Method

ASHRAE
Climate Zone 2

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min.[1] *R*-value	Assembly Maximum	Insulation Min.[1] R-value	Assembly Maximum	Insulation Min.[1] *R*-Value
Roofs						
Insulation all above deck	U-0.063	R-15.0 ci	U-0.063	R-15.0 ci	U-0.218	R-3.8 ci
Metal building	U-0.065	R-19.0	U-0.065	R-19	U-0.167	R-6.0
Attic and other	U-0.034	R-30.0	U-0.034	R-30.0	U-0.081	R-13.0
Walls, Above-Grade						
Mass	U-0.580	NR	U-0.151[2]	R-5.7 ci[2]	U-0.580	NR
Metal Building	U-0.113	R-13.0	U-0.113	R-13.0	U-0.184	R-6.0
Steel framed	U-0.124	R-13.0	U-0.124	R-13.0	U-0.352	NR
Wood framed and other	U-0.089	R-13.0	U-0.089	R-13.0	U-0.292	NR
Walls, Below-Grade						
Below-grade wall	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.137	R-4.2 ci	U-0.107	R-6.3 ci	U-0.322	NR
Steel Joist	U-0.052	R-19.0	U-0.052	R-19.0	U-0.350	NR
Wood framed and Other	U-0.051	R-19.0	U-0.051	R-19.0	U-0.282	NR
Slab-On-Grade Floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.700		U-0.700	
Nonswinging	U-1.450		U-1.450		U-1.450	
Fenestration	**Assembly Max U (Fixed/Operable)**	**Assembly Max. SHGC (All Orientations/North -Oriented)**	**Assembly Max. U (Fixed/Operable)**	**Assembly Max. SHGC (All Orientations/North -Oriented)**	**Assembly Max. U (Fixed/Operable)**	**Assembly Max. SHGC (All Orientations/North -Oriented)**
Vertical Glazing, % of wall						
0 - 10%	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.39 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.61 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ NR $SHGC_{north}$ NR
10.1 - 20%	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.44 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ NR $SHGC_{north}$ NR
20.1 - 30%	U_{fixed}–1.22 U_{oper}– 1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.44 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ NR $SHGC_{north}$ NR
30.1 - 40%	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.40 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ NR $SHGC_{north}$ NR
40.1 - 50%	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.17 $SHGC_{north}$ 0.42	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.29 $SHGC_{north}$ 0.41	U_{fixed}–0.98 U_{oper}–1.02	$SHGC_{all}$ NR $SHGC_{north}$ NR
Skylight with curb, glass, % roof						
0 - 2.0%	U_{all}–1.98	$SHGC_{all}$ 0.39	U_{all}–1.98	$SHGC_{all}$ 0.36	U_{all}–1.98	$SHGC_{all}$ NR
2.1 - 5.0%	U_{all}–1.98	$SHGC_{all}$ 0.25	U_{all}–1.98	$SHGC_{all}$ 0.19	U_{all}–1.98	$SHGC_{all}$ NR
Skylight with curb, plastic, % roof						
0 - 2.0%	U_{all}–1.90	$SHGC_{all}$ 0.65	U_{all}–1.90	$SHGC_{all}$ 0.27	U_{all}–1.90	$SHGC_{all}$ NR
2.1 - 5.0%	U_{all}–1.90	$SHGC_{all}$ 0.39	U_{all}–1.90	$SHGC_{all}$ 0.27	U_{all}–1.90	$SHGC_{all}$ NR
Skylight without curb, all, % roof						
0 - 2.0%	U_{all}–1.36	$SHGC_{all}$ 0.39	U_{all}–1.36	$SHGC_{all}$ 0.36	U_{all}–1.36	$SHGC_{all}$ NR
2.1 - 5.0%	U_{all}–1.36	$SHGC_{all}$ 0.25	U_{all}–1.36	$SHGC_{all}$ 0.19	U_{all}–1.36	$SHGC_{all}$ NR

[1] The following definitions apply: ci = continuous insulation; NR = no (insulation) requirements.
[2] Exception to 13-402.C.1 applies for mass walls.

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

SUBCHAPTER 4 – Commercial Building Compliance Methods

Form 400C-07
Building Prescriptive Envelope Method

ASHRAE
Climate Zone 1

Project Name:	Zone:
Address:	Building Classification:
City, Zip Code:	Building Permit No.:
Builder:	Permitting Office:
Owner:	Jurisdiction No.:

BUILDING ENVELOPE INFORMATION

ENVELOPE COMPONENT	Nonresidential		Residential		Semiheated	
	U-factor	*R*-value	*U*-factor	*R*-value	*U*-factor	*R*-value
Roof type:						
Wall type:						
Floor type:						
Fenestration	Max. *U*-factor Fixed/operable	Max. SHGC All orientation	Max. *U*-factor Fixed/operable	Max. SHGC All orientation	Max. *U*-factor Fixed/operable	Max. SHGC All orientation
Vertical glazing type, % of wall:						
Skylight type, % of roof:						

SYSTEMS INFORMATION

SYSTEM	Type (describe system)			Size (capacity)	Sizing calc.	Efficiency	Rating
Airconditioning system							
Heating system							
Ventilation							
Ducts	Location:			Fan Power:		*R*-value	
Piping	Fluid design operating temp:			Size of pipe:	-------	Inches	
Hot water					-------	EF	
Electric power	Drawings	Y	N	Operations manual available upon completion: Y N			
Motors	Open or enclosed			Poles & speed		*Horsepower:*	
Lighting	Space type:			Lighting power density			

PRESCRIPTIVE MEASURES

Components	Section	Requirements	Check
Operations Manual	13-102.1, 13-410, 13-413	Operations manual provided to owner.	
Windows & Doors	13-406.ABC.1.1	Glazed swinging entrance & revolving doors: max. 1.0 cfm/ft^2; all other products: 0.4 cfm/ft^2.	
Joints/Cracks	13-406.ABC.1.2	To be caulked, gasketed, weatherstripped or otherwise sealed.	
Dropped Ceiling Cavity	13-406.ABC.1.4	Vented: seal & insulated ceiling. Unvented seal & insulate roof & side walls.	
Reheat	13-407.BC	Electric resistance reheat prohibited.	
HVAC Efficiency	13-407, 13-408	Minimum efficiencies: Cooling Tables 13-407.ABC.3.2A-D; Heating Tables 13-407.ABC.3.2B, 13-407.ABC.3.2D, 13-408.ABC.3.2E *thru* 13-408.ABC.3.2G.	
HVAC Controls	13-407.ABC.2	Zone controls prevent reheat (exceptions); separate thermostatic control per zone; combined HAC control 5°F deadband (exceptions).	
Ventilation	13-409.ABC.3	Motorized dampers reqd. except gravity dampers OK in 1) exhaust systems and 2) systems with design outside air intake or exhaust capacity ≤300 cfm.	
HVAC Ducts	13-410.ABC	Air ducts, fittings, mechanical equipment & plenum chambers shall be mechanically attached, sealed, insulated & installed per Sec. 13-410.ABC. Fan power limitations.	
Balancing	13-410.ABC.4	HVAC distribution system(s) tested & balanced. Report in construction documents.	
Piping Insulation	13-411.ABC	In accordance with Table 13-411.ABC.2.	
Water Heaters	13-412.ABC	Performance requirements in accordance with Table 13-412.ABC.3. Heat trap required.	
Swimming Pools	13-412.ABC.2.6	Cover on heated pools; Time switch (exceptions); Readily accessible on/off switch.	
Hot Water Pipe Insulation	13-412.ABC.4	Table 13-411.ABC.2 for circulating systems, first 8' outlet pipe from storage tank, between inlet pipe and heat trap.	
Water Fixtures	13-412.ABC.2.5.2	Shower heat water flow restricted to 2.5 gpm at 80 psi. Public lavatory fixture max. Flow 0.5 gpm; if self-closing valve 0.25 gallon circulating, 0.5 gallon noncirculating.	
Lighting Controls	13-415.ABC	Automatic control required for interior lighting in buildings <5,000 s.f.; Space control; Exterior photo sensor; Tandem wiring where 1-3 linear fluorescent lamps >30W.	

If required by Florida law, I hereby certify that the system design is in compliance with the Florida Energy Code. Registration number
ARCHITECT: _____
ELECTRICAL SYSTEM DESIGNER: _____
LIGHTING SYSTEM DESIGNER: _____
MECHANICAL SYSTEM DESIGNER: _____
PLUMBING SYSTEM DESIGNER: _____

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.
PREPARED BY: _____ DATE: _____
I hereby certify that this building is in compliance with the Florida Energy Code:
OWNER AGENT: _____ DATE: _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.
BUILDING OFFICIAL: _____
DATE: _____

Form 400C-07
Building Prescriptive Envelope Method

ASHRAE
Climate Zone 1

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min.[1] *R*-value	Assembly Maximum	Insulation Min.[1] *R*-value	Assembly Maximum	Insulation Min.[1] *R*-Value
Roofs						
Insulation all above deck	U-0.063	R-15.0 ci	U-0.063	R-15.0 ci	U-1.282	NR
Metal building	U-0.065	R-19.0	U-0.065	R-19	U-1.280	NR
Attic and other	U-0.034	R-30.0	U-0.027	R-38.0	U-0.614	NR
Walls, Above-Grade						
Mass	U-0.580	NR	U-0.151[2]	R-5.7 ci[2]	U-0.580	NR
Metal building	U-0.113	R-13.0	U-0.113	R-13.0	U-1.180	NR
Steel framed	U-0.124	R-13.0	U-0.124	R-13.0	U-0.352	NR
Wood framed and other	U-0.089	R-13.0	U-0.089	R-13.0	U-0.292	NR
Walls, Below-Grade						
Below-grade wall	C-1.140	NR	C-1.140	NR	C-1.140	NR
Floors						
Mass	U-0.322	NR	U-0.322	NR	U-0.322	NR
Steel joist	U-0.350	NR	U-0.350	NR	U-0.350	NR
Wood framed and other	U-0.282	NR	U-0.282	NR	U-0.282	NR
Slab-On-Grade Floors						
Unheated	F-0.730	NR	F-0.730	NR	F-0.730	NR
Heated	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.700		U-0.700	
Nonswinging	U-1.450		U-1.450		U-1.450	
Fenestration	**Assembly Max U (Fixed/Operable)**	**Assembly Max. SHGC (All Orientations/North -Oriented)**	**Assembly Max. U (Fixed/Operable)**	**Assembly Max. SHGC (All Orientations/North -Oriented)**	**Assembly Max. U (Fixed/Operable)**	**Assembly Max. SHGC (All Orientations/North -Oriented)**
Vertical Glazing, % of wall						
0 - 10%	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ NR $SHGC_{north}$ NR
10.1 - 20%	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ NR $SHGC_{north}$ NR
20.1 - 30%	U_{fixed}–1.22 U_{oper}– 1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.61	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ NR $SHGC_{north}$ NR
30.1 - 40%	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.44	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.25 $SHGC_{north}$ 0.44	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ NR $SHGC_{north}$ NR
40.1 - 50%	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.19 $SHGC_{north}$ 0.33	U_{fixed}–1.22 U_{oper}–1.27	$SHGC_{all}$ 0.19 $SHGC_{north}$ 0.33	U_{fixed}–0.98 U_{oper}–1.02	$SHGC_{all}$ NR $SHGC_{north}$ NR
Skylight with curb, glass, % roof						
0 - 2.0%	U_{all}–1.98	$SHGC_{all}$ 0.36	U_{all}–1.98	$SHGC_{all}$ 0.19	U_{all}–1.98	$SHGC_{all}$ NR
2.1 - 5.0%	U_{all}–1.98	$SHGC_{all}$ 0.19	U_{all}–1.98	$SHGC_{all}$ 0.16	U_{all}–1.98	$SHGC_{all}$ NR
Skylight with curb, plastic, % roof						
0 - 2.0%	U_{all}–1.90	$SHGC_{all}$ 0.34	U_{all}–1.90	$SHGC_{all}$ 0.27	U_{all}–1.90	$SHGC_{all}$ NR
2.1 - 5.0%	U_{all}–1.90	$SHGC_{all}$ 0.27	U_{all}–1.90	$SHGC_{all}$ 0.27	U_{all}–1.90	$SHGC_{all}$ NR
Skylight without curb, all, % roof						
0 - 2.0%	U_{all}–1.36	$SHGC_{all}$ 0.36	U_{all}–1.36	$SHGC_{all}$ 0.19	U_{all}–1.36	$SHGC_{all}$ NR
2.1 - 5.0%	U_{all}–1.36	$SHGC_{all}$ 0.19	U_{all}–1.36	$SHGC_{all}$ 0.19	U_{all}–1.36	$SHGC_{all}$ NR

[1] The following definitions apply: ci = continuous insulation; NR = no (insulation) requirements.
[2] Exception to 13-402.C.1 applies for mass walls.

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 600A-07 — **Alternate Residential Points System Method** — **NORTH 1 2 3**

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 1 ☐ 2 ☐ 3 ☐
OWNER:		**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

	Please Type	CK
1. New construction or addition	1. _____	
2. Single-family detached or Multiple-family attached	2. _____	
3. If Multiple-family–No. of units covered by this submission	3. _____	
4. Is this a worst case? (yes/no)	4. _____	
5. Conditioned floor area (sq. ft.)	5. _____ sq. ft.	
6. Predominant eave overhang (ft.)	6. _____ ft.	
7. Glass type[1] and area: (Label required by 13-104.4.5 if not default)	Description Area	
a. *U*-factor: (or Single- or Double-Pane DEFAULT)	7a. _____ _____ sq. ft.	
b. SHGC: (or Clear or Tint DEFAULT)	7b. _____ _____ sq. ft.	
8. Floor type and insulation:		
a. Slab-on-grade (*R*-value + perimeter)	8a. R =_____ , _____ l. ft.	
b. Wood, raised (*R*-value + sq. ft.)	8b. R =_____ , _____ sq. ft.	
c. Concrete, raised (*R*-value)	8c. R =_____ , _____ sq. ft.	
9. Net wall type, area and insulation:		
a. Exterior: 1. Concrete block (Insulation *R*-value)	9a-1 R = _____ , _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9a-2 R = _____ , _____ sq. ft.	
3. Steel frame (Insulation *R*-value)	9a-3 R = _____ , _____ sq. ft.	
4. Log (Insulation *R*-value)	9a-4 R = _____ , _____ sq. ft.	
5. Other:_____		
b. Adjacent: 1. Concrete block (Insulation *R*-value)	9b-1 R = _____ , _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9b-2 R = _____ , _____ sq. ft.	
3. Steel frame (Insulation *R*-value)	9b-3 R = _____ , _____ sq. ft.	
4. Log (Insulation *R*-value)	9b-4 R = _____ , _____ sq. ft.	
10. Ceiling type, area and insulation:		
a. Under attic (Insulation *R*-value)	10a. _____ _____ sq. ft.	
b. Single assembly (Insulation *R*-value)	10b. _____ _____ sq. ft.	
c. Radiant barrier, IRCC or white roof installed?	10c. _____	
11. Air distribution system:		
a. Ducts (Insulation + Location)	11a. R = _____ , _____ (cond./uncond.)	
b. Air Handler (Location)	11b. R = _____ , _____ (cond./uncond.)	
12. Cooling system:	12a. Type: _____	
(Types: central-split, central-single pkg., room unit, PTAC, gas, none)	12b. SEER/EER/COP: _____	
	12c. Capacity: _____	
13. Heating system:	13a. Type: _____	
(Types: heat pump, elec. strip, nat. gas, LP gas, gas h.p., room or PTAC, none)	13b. HSPF/COP/AFUE: _____	
	13c. Capacity: _____	
14. Hot water system:	14a. Type: _____	
(Types: elec., natural gas, solar, LP gas, none)	14b. EF: _____	
15. Hot water credits	15a. _____	
a. Heat Recovery (HR)	15b. _____	
b. Dedicated Heat Pump (DHP)	15c. _____	
c. Solar	16. _____	
16. HVAC Credits	17. _____	
(Use: CF-ceiling fan, CV-cross vent, PT-programmable thermostat, HF-whole house fan, MZ-Multizone)	17a._____17b. _____	
17. COMPLIANCE STATUS: (PASS if As-Built Pts. are less than Base Pts.)		

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY:_____ **DATE:**_____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT:_____ **DATE:**_____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL:_____

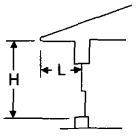
DATE:_____

[1] Predominant glass type. For actual glass type and areas, see summer and winter glass output on Pages 2 and 4.

SUMMER CALCULATIONS

CLIMATE ZONES 1 2 3

GLASS	ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE SUMMER POINT MULTIPLIER CLEAR	SINGLE-PANE SUMMER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE SUMMER POINT MULTIPLIER CLEAR	DOUBLE-PANE SUMMER POINT MULTIPLIER TINT[2]	X SUMMER OH FACTOR (from 6A-1) =	AS-BUILT GLASS SUMMER PTS
	N			21.73	17.28	19.20	14.84		
	NE			33.55	27.37	29.56	23.48		
	E			47.92	39.62	42.06	33.89		
	SE			48.65	40.24	42.75	34.47		
	S			40.81	33.55	35.87	28.73		
	SW			45.75	37.77	40.16	32.30		
	W			43.84	36.13	38.52	30.93		
	NW			29.42	23.83	25.97	20.48		
	H[1]			84.46	68.97	74.77	59.51		



OVERHANG RATIO = $\frac{\text{OH LENGTH}}{\text{OH HEIGHT}}$

GLASS	.18 X	COND FLOOR AREA X	WEIGHTED GLASS MULTIPLIER =	BASE GLASS SUBTOTAL
	.18		18.59	

AS-BUILT GLASS SUBTOTAL: ____

	COMPONENT DESCRIPTION	AREA X	BASE SUMMER POINT. MULT	BASE SUMMER POINTS	COMPONENT DESCRIPTION	AREA X	SUMMER POINT MULT. (6A-2 THRU 6A-6) =	AS-BUILT SUMMER POINTS
WALL	EXTERIOR		1.5					
	ADJACENT		.6					
DOORS	EXTERIOR		6.1					
	ADJACENT		2.4					
CEILING	UNDER ATTIC OR SINGLE ASSEMBLY		1.73					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		-41.2					
	RAISED (AREA)		-.98					
	FOR SLAB-ON-GRADE USE PERIMIETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			10.21				10.21	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE SUMMER POINTS	TOTAL COMPONENT AS-BUILT SUMMER POINTS

	Base Cooling System Multiplier X	Total Base Summer Points =	BASE COOLING POINTS	TOTAL AS-BUILT SUM. PTS. X	As-Built DM (6A-8) X	As-Built DSM (6A-20) X	As Built AHU (6A-7) X	As Built CSM (6A-9) X	As Built CCM (6A-19) =	AS-BUILT COOLING POINTS
COOLING SYSTEM	.325					1.15 or 1.0				

	Number of bedrooms X	Base Hot Water Multiplier =	BASE HOT WATER POINTS	AS-BUILT HOT WATER SYSTEM DESC.	Number of bedrooms X	As-Built HWM (6A-22) X	As Built HWCM (6A-23) =	AS-BUILT HOT WATER POINTS
HOT WATER SYSTEM		2635						

[1] H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 APPENDIX C. TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3] MUST MEET CRITERIA OF S.607.1.A.

SUMMER POINT MULTIPLIERS (SPM)

CLIMATE ZONES 1 2 3

6A-1 SUMMER OVERHANG FACTORS (SOF) FOR SINGLE-AND DOUBLE-PANE GLASS

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.993	0.971	0.930	0.888	0.842	0.803	0.766	0.736	0.681	0.634	0.593
Northeast	1.00	0.996	0.967	0.907	0.845	0.775	0.717	0.662	0.619	0.545	0.487	0.441
East	1.00	0.994	0.963	0.898	0.827	0.745	0.675	0.609	0.558	0.470	0.405	0.357
Southeast	1.00	0.998	0.952	0.864	0.777	0.689	0.623	0.566	0.525	0.459	0.413	0.379
South	1.00	0.989	0.931	0.835	0.751	0.675	0.620	0.575	0.543	0.493	0.458	0.432
Southwest	1.00	0.998	0.953	0.866	0.779	0.691	0.623	0.565	0.522	0.453	0.404	0.368
West	1.00	0.994	0.963	0.899	0.828	0.748	0.681	0.617	0.569	0.485	0.422	0.375
Northwest	1.00	0.996	0.968	0.913	0.858	0.797	0.748	0.702	0.667	0.605	0.556	0.516
OH Length	**0.0'**	**1.0'**	**1.5'**	**2.0'**	**3.0'**	**3.5'**	**4.5'**	**5.5'**	**6.5'**	**9.5'**	**14.0'**	**20.0'**

6A-2 WALL SUMMER POINT MULTIPLIERS (SPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	*R*-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT	0-6.9	2.4	0-2.9	1.0	*R*-VALUE	EXT	EXT
0-6.9	5.5	2.2	7.6	2.8	0-2.9	2.2	1.1	2.2	7-10.9	.6	3-6.9	.6	0-2.9	1.5	1.0
7-10.9	2.1	.8	3.5	1.3	3-4.9	1.3	.8	.8	11-18.9	.4	7-9.9	.4	3-6.9	1.0	.7
11-12.9	1.7	.7	2.7	1.0	5-6.9	1.0	.7	.5	19-25.9	.2	10 & UP	.2	7 & UP	.8	.6
13-18.9	1.5	.6	2.5	0.9	7-10.9	.7	.5	.3	26 & UP	.1					
19-25.9	.9	.4	2.2	0.8	11-18.9	.4	.4	0							
26 & UP	.6	.2	1.2	0.4	19-25.9	.2	.2								
					26 & UP	.1	.1								

NOTE: SEE SECTION 2.0 OF APPENDIX C FOR MULTIPLIERS OF ENVELOPE COMPONENTS NOT ON THIS FORM.

6A-3 DOOR SUMMER POINT MULTIPLIERS (SPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	6.1	2.4
INSULATED	4.1	1.6

6A-4 CEILING SUMMER POINT MULTIPLIERS (SPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
					CEILING TYPE	
R-VALUE	SPM	*R*-VALUE	SPM	*R*-VALUE	EXPOSED	DROPPED
19-21.9	2.34	10-10.9	8.49	10-13.9	9.13	8.47
22-25.9	2.11	11-12.9	7.97	14-20.9	6.80	6.45
26-29.9	1.89	13-18.9	7.14	21 & UP	4.92	4.63
30-37.9	1.73	19-25.9	5.64			
38 & UP	1.52	26-29.9	4.75			
RBS Credit	0.700	30 & UP	4.40			
IRCC Credit	0.849					
White Roof Credit	0.550					

6A-5 FLOOR SUMMER POINT MULTIPLIERS (SPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	SPM	*R*-VALUE	SPM	*R*-VALUE	SPM	SPM	SPM
0-2.9	-41.2	0-2.9	-.8	0-6.9	2.80	-4.7	2.2
3-4.9	-37.2	3-4.9	-1.3	7-10.9	1.34	-2.3	.8
5-6.9	-36.2	5-6.9	-1.3	11-18.9	1.06	-1.9	.7
7 & UP	-35.7	7 & UP	-1.3	19 & UP	.77	-1.5	.4

6A-6 INFILTRATION & INTERNAL GAINS (SPM)

Air Infiltration	3.44
Internal Gains	6.77
Infiltration/Internal Gains (Combined)	10.21

6A-7 AIR HANDLER MULTIPLIERS (SPM)

Located in garage	1.00
Located in conditioned area	0.91
Located on exterior of building	1.02
Located in attic	1.11

6A-8 DUCT MULTIPLIERS (DM) See Table 13-610.1.ABC.2.1 for code minimums.

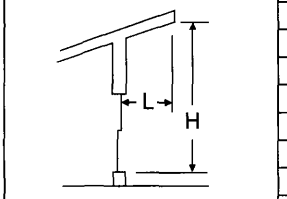
SUPPLY DUCTS IN:	DUCT *R*-VALUE	RETURN DUCTS IN:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.118	1.111	1.112	1.089	1.107
	6.0	1.090	1.084	1.085	1.066	1.081
	8.0	1.071	1.066	1.067	1.051	1.064
Attic/Radiant Barrier (RBS)	4.2	1.072	1.066	—	—	1.061
	6.0	1.056	1.051	—	—	1.047
	8.0	1.045	1.041	—	—	1.037
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.099	—	1.092	—	1.084
	6.0	1.076	—	1.071	—	1.065
	8.0	1.061	—	1.057	—	1.052
Attic/Cool Roof	4.2	1.068	—	—	1.096	1.057
	6.0	1.051	—	—	1.071	1.043
	8.0	1.040	—	—	1.055	1.034
Conditioned Space	4.2	1.006	1.005	1.007	1.008	1.000
	6.0	1.005	1.004	1.005	1.006	1.000
	8.0	1.004	1.003	1.004	1.005	1.000

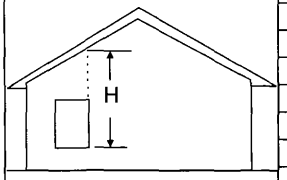
6A-9 COOLING SYSTEM MULTIPLIERS (CSM)

SYSTEM TYPE See Table 13-607.1.ABC.3.2.A,B,D for code minimums		COOLING SYSTEM MULTIPLIERS (CSM)										
Central Units (SEER)	Rating		7.5-7.9	8.0-8.4	8.5-8.8	8.9-9.4	9.5-9.9	10.0-10.4	10.5-10.9	11.0-11.4	11.5-11.9	12.0-12.4
	CSM		.45	.43	.40	.38	.36	.34	.32	.31	.30	.28
PTAC & Room Units (EER)	Rating	12.5-12.9	13.0-13.4	13.5-13.9	14.0-14.4	14.5-14.9	15.0-15.4	15.5-15.9	16.0-16.4	16.5-16.9	17.0-17.4	17.5 & UP
	CSM	.27	.26	.25	.24	.24	.23	.22	.21	.21	.20	.19

WINTER CALCULATIONS

CLIMATE ZONES 1 2 3





GLASS	ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.)	X SINGLE-PANE WINTER POINT MULTIPLIER CLEAR	SINGLE-PANE WINTER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE WINTER POINT MULTIPLIER CLEAR	DOUBLE-PANE WINTER POINT MULTIPLIER TINT[2]	X WINTER OH FACTOR (from 6A-10)	= AS-BUILT GLASS WINTER PTS
	N			33.22	34.06	24.58	25.37		
	NE			32.04	33.05	23.57	24.53		
	E			26.41	28.18	18.79	20.51		
	SE			21.82	24.24	14.71	17.06		
	S			20.24	22.87	13.30	15.87		
	SW			24.09	26.20	16.74	18.79		
	W			28.84	30.32	20.73	22.15		
	NW			32.93	33.82	24.30	25.14		
	[1]H			29.19	31.47	19.86	22.11		

GLASS	.18 X COND. FLOOR AREA	X WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL
	.18	20.17	

AS-BUILT GLASS SUBTOTAL: ____

	COMPONENT DESCRIPTION	AREA	X BASE WINTER POINT. MULT.	= BASE WINTER POINTS	COMPONENT DESCRIPTION	AREA	WINTER POINT MULT. (6A-11 THRU 6A-15)	AS-BUILT WINTER POINTS
WALL	EXTERIOR		3.4					
	ADJACENT		3.3					
DOORS	EXTERIOR		12.3					
	ADJACENT		11.5					
CEILING	UNDER ATTIC OR SINGLE ASSEMBLY		2.05					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		18.8					
	RAISED (AREA)		1.38					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			-0.58				-0.58	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE WINTER POINTS		TOTAL COMPONENT AS-BUILT WINTER POINTS	

HEATING SYSTEM	Base Heating System Multiplier	X Total Base Winter Points	= BASE HEATING POINTS	TOTAL AS-BUILT WIN. PTS.	X As-Built DM (6A-17)	X As-Built DSM (6A-20)	X As Built AHU (6A-16)	X As Built HSM (6A-18)	X As Built HCM (6A-21)	= AS-BUILT HEATING POINTS
	.554					1.17 or 1.0				

BASE COOLING POINTS (From P. 2)	+ BASE HEATING POINTS	+ BASE HOT WATER POINTS (From P. 2)	= TOTAL BASE POINTS (Enter on P. 1)	AS-BUILT COOLING POINTS (From P. 2)	+ AS-BUILT HEATING POINTS	+ AS-BUILT HOT WATER POINTS (From P. 2)	= TOTAL AS-BUILT POINTS (Enter on P. 1)

[1]H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1, APPENDIX C. TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3]MUST MEET CRITERIA OF S.607.1A.

WINTER POINT MULTIPLIERS (WPM)

CLIMATE ZONES 1 2 3

6A-10 WINTER OVERHANG FACTORS (WOF)

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	1.000	1.001	1.003	1.005	1.009	1.011	1.014	1.016	1.021	1.024	1.027
Northeast	1.00	0.998	1.001	1.008	1.015	1.023	1.029	1.035	1.040	1.049	1.056	1.061
East	1.00	1.007	1.018	1.040	1.069	1.109	1.150	1.198	1.242	1.338	1.429	1.507
Southeast	1.00	1.014	1.043	1.111	1.202	1.332	1.472	1.635	1.787	2.113	2.412	2.650
South	1.00	0.994	1.032	1.142	1.308	1.563	1.845	2.175	2.471	3.042	3.450	3.661
Southwest	1.00	1.006	1.025	1.070	1.131	1.217	1.308	1.413	1.508	1.708	1.888	2.031
West	1.00	1.002	1.010	1.027	1.049	1.077	1.102	1.128	1.149	1.187	1.217	1.238
Northwest	1.00	0.999	1.000	1.004	1.008	1.012	1.016	1.019	1.022	1.028	1.032	1.036
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-11 WALL WINTER POINT MULTIPLIERS (WPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	R-VALUE	WOOD FR	R-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	R-VALUE	EXT	ADJ	EXT	0-6.9	12.6	0-2.9	7.9	R-VALUE	EXT	EXT
0-6.9	11.1	10.4	15.1	13.1	0-2.9	11.2	6.8	11.2	7-10.9	4.2	3-6.9	5.7	0-2.9	4.5	3.0
7-10.9	4.4	4.4	7.3	6.6	3-4.9	7.3	5.1	5.6	11-18.9	3.5	7-9.9	3.8	3-6.9	2.8	2.2
11-12.9	3.7	3.6	5.7	5.2	5-6.9	5.7	4.2	4.3	19-25.9	2.2	10 & UP	3.0	7 & UP	2.1	1.7
13-18.9	3.4	3.3	5.2	4.9	7-10.9	4.6	3.5	3.3	26 & UP	1.4					
19-25.9	2.2	2.2	4.6	4.4	11-18.9	3.0	2.6	2.2							
26 & Up	1.5	1.5	2.7	2.6	19-25.9	1.9	1.7								
					26 & UP	1.3	1.2								

NOTE: SEE SECTION 2.0 OF APPENDIX C FOR MULTIPLIERS OF ENVELOPE COMPONENTS NOT ON THIS FORM.

6A-12 DOOR WINTER POINT MULTIPLIERS (WPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	12.3	11.5
INSULATED	8.4	8.0

6A-13 CEILING WINTER POINT MULTIPLIERS (WPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
R-VALUE	WPM	R-VALUE	WPM		CEILING TYPE	
19-21.9	2.70	10-10.9	2.87	R-VALUE	EXPOSED	DROPPED
22-25.9	2.45	11-12.9	2.70	10-13.9	3.16	2.91
26-29.9	2.22	13-18.9	2.40	14-20.9	2.31	2.14
30-37.9	2.05	19-25.9	1.86	21 & UP	1.47	1.47
38 & UP	1.81	26-29.9	1.54			
RBS Credit	0.850	30 & UP	1.43			
IRCC Credit	0.912					
White Roof Credit	1.044					

6A-14 FLOOR WINTER POINT MULTIPLIERS (WPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	WPM	R-VALUE	WPM	R-VALUE	WPM	WPM	WPM
0-2.9	18.8	0-2.9	9.9	0-6.9	5.77	3.5	10.4
3-4.9	9.3	3-4.9	5.1	7-10.9	2.20	1.6	4.4
5-6.9	7.6	5-6.9	3.6	11-18.9	1.55	1.2	3.6
7 & UP	7.0	7 & UP	2.9	19 & UP	0.88	.8	2.2

6A-15 INFILTRATION & INTERNAL GAINS (WPM)

Air Infiltration	2.13
Internal Gains	-2.72
Infiltration/Internal Gains (Combined)	-0.58

6A-16 AIR HANDLER MULTIPLIERS (WPM)

Located in garage	1.00
Located in conditioned area	0.93
Located on exterior of building	1.07
Located in attic	1.10

6A-17 DUCT MULTIPLIERS (DM) See Table 13-610.1.ABC.2.1 for code minimums.

SUPPLY DUCTS IN:	DUCT R-VALUE	RETURN DUCTS IN: Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.093	1.086	1.088	1.089	1.081
	6.0	1.069	1.064	1.065	1.066	1.060
	8.0	1.053	1.049	1.051	1.051	1.046
Attic/Radiant Barrier (RBS)	4.2	1.067	1.059	—	—	1.052
	6.0	1.051	1.045	—	—	1.040
	8.0	1.040	1.036	—	—	1.032
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.096	—	1.088	—	1.077
	6.0	1.072	—	1.066	—	1.057
	8.0	1.056	—	1.052	—	1.045
Attic/Cool Roof	4.2	1.104	—	—	1.096	1.083
	6.0	1.076	—	—	1.071	1.061
	8.0	1.059	—	—	1.055	1.048
Conditioned Space	4.2	1.008	1.007	1.010	1.008	1.000
	6.0	1.006	1.005	1.007	1.006	1.000
	8.0	1.005	1.004	1.006	1.005	1.000

6A-18 HEATING SYSTEM MULTIPLIERS (HSM) All Climate Zones

SYSTEM TYPE See Table N1108.ABC.3.2 B for code minimums		HEATING SYSTEM MULTIPLIERS (HSM)							
Central Heat Pump Units	HSPF	7.4-7.6	7.7-7.8	7.9-8.3	8.4-8.8	8.9-9.3	9.4-9.8	9.9-10.3	10.4-10.8
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
PTHP	COP	2.50-1.69	2.70-2.89	2.90-3.09	3.10-3.29	3.30-3.49	3.50-3.69	3.70-3.89	3.90-4.19
	HSM	.40	.37	.34	.32	.30	.29	.27	.26
Gas Heating	AFUE	76-.77	.78	79-.82	83-.85	86-.89	90-.92	93-.95	96-.98
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
Electric Strip		1.0							

ADDITIONAL TABLES

CLIMATE ZONES 1 2 3

6A-19 COOLING CREDIT MULTIPLIERS

SYSTEM TYPE	Cooling credit multipliers (CCM)
Ceiling Fans	.95*
Cross Ventilation	.95*
Whole House Fan	.95*
Multizone	.95
Programmable Thermostat	.95

*Credit may be taken for only one system type concurrently.

6A-20 AIR DISTRIBUTION SYSTEM CREDIT MULTIPLIERS

TYPE CREDIT	Prescriptive requirements	Multiplier
Air-tight Duct Credit[1]	Appx G-C5.2.2.1.1	1.00
Factory-sealed AHU Credit[2]	Appx G-C5.2.2.1.2	0.95

[1]Duct Sealing Multiplier (DSM) shall be 1.15 (summer) or 1.17 (winter) unless Air-tight Duct Credit is demonstrated by test report.
[2]Multiply Factory-sealed AHU credit by summer (Table 6A-7) or winter (Table 6A-16) AHU multiplier. Insert total in the "As-Built AHU" box on page 2 or 4.

6A-21 HEATING CREDIT MULTIPLIERS (HCM)

SYSTEM TYPE		HEATING CREDIT MULTIPLIERS (HCM)
Programmable Thermostat	HCM	.95
Multizone	HCM	.95

6A-22 HOT WATER MULTIPLIERS (HWM)

SYSTEM TYPE See Table N1112.ABC.3.2 for code minimums									
Electric Resistance	EF	.80-.81	.82-.83	.84-.85	.86-.87	.88-.90	.91-.93	.94-.96	.97 &Up
	HWM	3020	2946	2876	2809	2746	2655	2571	2491
Gas Water Heating	EF	.54	.55	.56	.57	.58	.59	.60	.61
	HWM	3020	2946	2876	2809	2746	2655	2571	2491
	EF	.62-.63	.64-.65	.66-.70	.71-.75	.76-.80	.81-.83	.84-.86	.87 & Up
	HWM	2346	2217	2101	1738	1456	1196	1055	933

6A-23 HOT WATER CREDIT MULTIPLIERS (HWCM)

SYSTEM TYPE		HOT WATER CREDIT MULTIPLIERS (HWCM)				
Heat Recovery Unit	With	Air Conditioner		Heat Pump		
	HWCM	.84		.78		
Add-on Dedicated Heat Pump (without tank)	EF	2.0-2.49	2.5-2.99	3.0-3.49	3.5 & Up	
	HWCM	.44	.35	.29	.25	
Add-on Solar Water Heater (without tank)	EF	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0 & Up
	HWCM	.84	.42	.28	.21	.17

NOTE: An HWM must be used in conjunction with all HWCM. See Table 6A-22. EF Means Energy Factor.

6A-24 INFILTRATION REDUCTION COMPLIANCE CHECKLIST

COMPONENTS	SECTION	REQUIREMENTS FOR EACH PRACTICE	CHECK
Exterior Windows & Doors	N1106.ABC.1.1	Max: 3 cfm/sq. ft. window area; .5cfm/sq. ft. door area.	
Exterior & Adjacent Walls	N1106.ABC.1.2.1	Caulk, gasket, weatherstrip or seal between: windows/doors & frames, surrounding wall; foundation & wall sole or sill plate; joints between exterior wall panels at corners; CFM utility penetrations; between wall panels & top/bottom plates; between walls & floor. EXCEPTION: Frame walls where a continous infiltration barrier is installed that extends from, and is sealed to, the foundation to the top plate.	
Floors	N1106.ABC.1.2.2	Penetrations/openings >1/8" sealed unless backed by truss or joint members. EXCEPTION: Frame floors where a continuous infiltration barrier is installed that is sealed to the perimeter, penetrations and seams.	
Ceilings	N1106.ABC.1.2.3	Seal: Between walls & ceilings: penetrations of ceiling plane of top floor; around shafts, chases, soffits, chimneys, cabinets sealed to continuous air barrier; gaps in gyp board & top plate; attic access. EXCEPTION: Frame ceilings where a continuous infiltration barrier is installed that is sealed at the perimeter, at penetrations and seams.	
Recessed Lighting Fixtures	N1106.ABC.1.2.4	Type IC rated with no penetrations, sealed; or Type IC or non-IC rated, installed inside a sealed box with 1/2" clearance & 3" from insulation; or Type IC rated with <2.0 cfm from conditioned space, tested.	
Multiple Story Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Additional Infiltration reqts	N1106.ABC.1.3	Exhaust fans vented to outdoors, dampers; combustion space heaters comply with NFPA, have combustion air.	

6A-25 OTHER PRESCRIPTIVE MEASURES (must be met or exceeded by all residences.)

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker (electric) or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have a minimum thermal efficiency of 78%.	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
Air Distribution Systems	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated, and installed in accordance with the criteria of Section N1110. Ducts in unconditioned attics: R-6 minimum insulation.	
HVAC Controls	N1107.ABC.2	Separate readily accessible manual or automatic thermostat for each system.	
Insulation	N1104.ABC.1 N1102.BC.1.1	Ceilings–Min. R-19. Common walls–Frame R-11 or CBS R-3 both sides. Common ceiling & floors R-11.	

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 600A-07 — **Alternate Residential Points System Method** — **CENTRAL 4 5 6**

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 4 ☐ 5 ☐ 6 ☐
OWNER:		**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

	Please Type	CK
1. New construction or addition	1. _____	
2. Single-family detached or Multiple-family attached	2. _____	
3. If Multiple-family–No. of units covered by this submission	3. _____	
4. Is this a worst case? (yes/no)	4. _____	
5. Conditioned floor area (sq. ft.)	5. _____ sq. ft.	
6. Predominant eave overhang (ft.)	6. _____ ft.	
7. Glass type[1] and area: (Label required by 13-104.4.5 if not default)	Description Area	
a. *U*-factor: (or Single- or Double-Pane DEFAULT)	7a. _____ _____ sq. ft.	
b. SHGC: (or Clear or Tint DEFAULT)	7b. _____ _____ sq. ft.	
8. Floor type and insulation:		
a. Slab-on-grade (*R*-value + perimeter)	8a. R =_____ , _____ l. ft.	
b. Wood, raised (*R*-value + sq. ft.)	8b. R =_____ , _____ sq. ft.	
c. Concrete, raised (*R*-value)	8c. R =_____ , _____ sq. ft.	
9. Net Wall type, area and insulation:		
a. Exterior: 1. Concrete block (Insulation *R*-value)	9a-1 R = _____ , _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9a-2 R = _____ , _____ sq. ft.	
3. Steel frame (Insulation *R*-value)	9a-3 R = _____ , _____ sq. ft.	
4. Log (Insulation *R*-value)	9a-4 R = _____ , _____ sq. ft.	
5. Other:_____		
b. Adjacent: 1. Concrete block (Insulation *R*-value)	9b-1 R = _____ , _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9b-2 R = _____ , _____ sq. ft.	
3. Steel frame (Insulation *R*-value)	9b-3 R = _____ , _____ sq. ft.	
4. Log (Insulation *R*-value)	9b-4 R = _____ , _____ sq. ft.	
10. Ceiling type, area and insulation:		
a. Under attic (Insulation *R*-value)	10a. _____ _____ sq. ft.	
b. Single assembly (Insulation *R*-value)	10b. _____ _____ sq. ft.	
c. Radiant barrier, IRCC or white roof installed?	10c. _____	
11. Air distribution system:		
a. Ducts (Insulation + Location)	11a. R = _____ , _____ (cond./uncond.)	
b. Air Handler (Location)	11b. R = _____ , _____ (cond./uncond.)	
12. Cooling system:	12a. Type: _____	
(Types: central-split, central-single pkg., room unit, PTAC, gas, none)	12b. SEER/EER/COP: _____	
	12c. Capacity: _____	
13. Heating system:	13a. Type: _____	
(Types: heat pump, elec. strip, nat. gas, LP Gas, gas h.p., room or PTAC, none)	13b. HSPF/COP/AFUE: _____	
	13c. Capacity: _____	
14. Hot water system:	14a.Type: _____	
(Types: elec., natural gas, solar, LP gas, none)	14b. EF: _____	
15. Hot water credits	15a. _____	
a. Heat Recovery (HR)	15b. _____	
b. Dedicated Heat Pump (DHP)	15c. _____	
c. Solar		
16. HVAC credits	16. _____	
(Use: CF-Ceiling Fan, CV-cross vent, PT-programmable thermostat, HF-whole house fan, MZ-Multizone)		
17. COMPLIANCE STATUS: (PASS if As-Built Pts. Are less than Base Pts.)	17. _____	
a. Total As-Built Points b. Total Base Points	17a._____ 17b. _____	

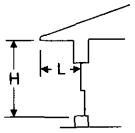
I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.	Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.
PREPARED BY: _____ **DATE:** _____	
I hereby certify that this building is in compliance with the Florida Energy Code:	**BUILDING OFFICIAL:** _____
OWNER AGENT: _____ **DATE:** _____	**DATE:** _____

[1] Predominant glass type. For actual glass type and areas, see summer and winter glass output on Pages 2 and 4.

SUMMER CALCULATIONS

CLIMATE ZONES 4 5 6

GLASS	ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE SUMMER POINT MULTIPLIER CLEAR	SINGLE-PANE SUMMER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE SUMMER POINT MULTIPLIER CLEAR	DOUBLE-PANE SUMMER POINT MULTIPLIER TINT[2] X	SUMMER OH FACTOR (from 6A-1)	AS-BUILT GLASS SUMMER PTS =
	N			30.19	24.46	26.25	20.63		
	NE			47.10	38.88	40.99	32.90		
	E			63.97	53.27	55.69	45.16		
	SE			61.07	50.80	53.20	43.09		
	S			48.22	39.84	41.92	33.69		
	SW			56.99	47.31	49.60	40.08		
	W			57.68	47.90	50.22	40.60		
	NW			40.72	33.43	35.45	28.29		
	[1]H			109.69	89.83	96.56	77.00		



OVERHANG RATIO = $\frac{\text{OH LENGTH}}{\text{OH HEIGHT}}$

GLASS	.18 X	COND. FLOOR AREA X	WEIGHTED GLASS MULTIPLIER =	BASE GLASS SUBTOTAL	AS-BUILT GLASS SUBTOTAL
	.18		24.35		

	COMPONENT DESCRIPTION	AREA X	BASE SUMMER POINT MULT =	BASE SUMMER POINTS	COMPONENT DESCRIPTION	AREA	SUMMER POINT MULT. (6A-2 THRU 6A-6) =	AS-BUILT SUMMER POINTS
WALL	EXTERIOR		1.7					
	ADJACENT		.6					
DOORS	EXTERIOR		4.8					
	ADJACENT		1.6					
CEILING	UNDER ATTIC OR SINGLE ASSEMBLY		2.13					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		-31.9					
	RAISED (AREA)		-1.71					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			14.31				14.31	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE SUMMER POINTS		TOTAL COMPONENT AS-BUILT SUMMER POINTS	

	Base Cooling System Multiplier X	Total Base Summer Points =	BASE COOLING POINTS	TOTAL AS-BUILT SUM. PTS. X	As-Built DM (6A-8) X	As-Built DSM (6A-20) X	As-Built AHU (6A-7) X	As-Built CSM (6A-9) X	As-Built CCM (6A-19) =	AS-BUILT COOLING POINTS
COOLING SYSTEM	.325					1.15 or 1.0				

	Number of Bedrooms X	Base Hot Water Multiplier =	BASE HOT WATER POINTS	AS-BUILT HOT WATER SYSTEM DESC.	Number of Bedrooms X	As-Built HWM (6A-22) X	As-Built HWCM (6A-23) =	AS-BUILT HOT WATER POINTS
HOT WATER SYSTEM		2460						

[1]H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 APPENDIX C. TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3]MUST MEET CRITERIA OF S.607.1A.

SUMMER POINT MULTIPLIERS (SPM)

CLIMATE ZONES 4 5 6

6A-1 SUMMER OVERHANG FACTORS (SOF) FOR SINGLE AND DOUBLE-PANE GLASS

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.992	0.971	0.931	0.891	0.848	0.811	0.776	0.748	0.695	0.651	0.611
Northeast	1.00	0.995	0.966	0.908	0.846	0.777	0.719	0.665	0.623	0.549	0.491	0.445
East	1.00	0.993	0.964	0.903	0.835	0.755	0.687	0.622	0.571	0.482	0.414	0.463
Southeast	1.00	0.999	0.956	0.871	0.786	0.700	0.635	0.580	0.540	0.478	0.436	0.407
South	1.00	0.988	0.935	0.849	0.776	0.708	0.659	0.618	0.588	0.539	0.503	0.475
Southwest	1.00	0.997	0.956	0.874	0.793	0.709	0.645	0.588	0.547	0.479	0.431	0.396
West	1.00	0.994	0.964	0.902	0.834	0.757	0.691	0.630	0.582	0.500	0.438	0.391
Northwest	1.00	0.995	0.966	0.911	0.857	0.798	0.751	0.708	0.674	0.616	0.570	0.532
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-2 WALL SUMMER POINT MULTIPLIERS (SPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	R-VALUE	WOOD FR	R-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	R-VALUE	EXT	ADJ	EXT	0-6.9	2.9	0-2.9	1.0	R-VALUE	EXT	EXT
0-6.9	6.4	2.2	8.9	2.9	0-2.9	2.5	.9	2.5	7-10.9	.6	3-6.9	.6	0-2.9	1.7	1.0
7-10.9	2.3	.8	4.1	1.3	3-4.9	1.4	.7	.7	11-18.9	.4	7-9.9	.4	3-6.9	1.1	.8
11-12.9	1.9	.7	3.0	1.0	5-6.9	1.0	.6	.3	19-25.9	.2	10 & UP	.2	7 & UP	.8	.7
13-18.9	1.7	.6	2.8	0.9	7-10.9	.8	.4	.1	26 & UP	.1					
19-25.9	1.0	.3	2.4	0.8	11-18.9	.4	.3	0							
26 & UP	.6	.2	1.3	0.4	19-25.9	.2	.2								
					26 & Up	.1	.1								

NOTE: SEE SECTION 2.0 OF APPENDIX C FOR MULTIPLIERS OF ENVELOPE COMPONENTS NOT ON THIS FORM.

6A-3 DOOR SUMMER POINT MULTIPLIERS (SPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	7.2	2.4
INSULATED	4.8	1.6

6A-4 CEILING SUMMER POINT MULTIPLIERS (SPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
					CEILING TYPE	
R-VALUE	SPM	R-VALUE	SPM	R-VALUE	EXPOSED	DROPPED
19-21.9	2.82	10-10.9	10.27	10-13.9	11.13	10.40
22-25.9	2.55	11-12.9	9.73	14-20.9	8.42	7.99
26-29.9	2.28	13-18.9	8.72	21 & UP	5.99	5.76
30-37.9	2.13	19-25.9	6.90			
38 & UP	1.84	26-29.9	5.82			
RBS Credit	0.700	30 & Up	5.40			
IRCC Credit	0.864					
White Roof Credit	0.550					

6A-5 FLOOR SUMMER POINT MULTIPLIERS (SPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	SPM	R-VALUE	SPM	R-VALUE	SPM	SPM	SPM
0-2.9	-31.9	0-2.9	-1.0	0-6.9	4.50	-5.8	5.3
3-4.9	-31.8	3-4.9	-1.7	7-10.9	2.28	-2.8	2.1
5-6.9	-31.7	5-6.9	-1.7	11-18.9	1.83	-2.2	1.8
7 & UP	-31.6	7 & UP	-1.7	19 & UP	1.36	-1.8	1.0

6A-6 INFILTRATION & INTERNAL GAINS (SPM)

Air Infiltration	5.17
Internal Gains	+9.14
Infiltration/Internal Gains (Combined)	14.31

6A-7 AIR HANDLER MULTIPLIERS (SPM)

Located in garage	1.00
Located in conditioned area	0.90
Located on exterior of building	1.02
Located in attic	1.10

6A-8 DUCT MULTIPLIERS (DM) See Table 13-610.1.ABC.2.1 for Code minimums.

SUPPLY DUCTS IN:	DUCT R-VALUE	RETURN DUCTS In:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.113	1.107	1.108	1.107	1.103
	6.0	1.087	1.081	1.083	1.081	1.079
	8.0	1.069	1.064	1.065	1.064	1.062
Attic/Radiant Barrier (RBS)	4.2	1.072	1.066	—	—	1.061
	6.0	1.056	1.051	—	—	1.047
	8.0	1.045	1.041	—	—	1.038
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.098	—	1.092	—	1.084
	6.0	1.076	—	1.071	—	1.065
	8.0	1.060	—	1.057	—	1.052
Attic/Cool Roof	4.2	1.069	—	—	1.063	1.058
	6.0	1.052	—	—	1.047	1.044
	8.0	1.041	—	—	1.037	1.034
Conditioned Space	4.2	1.006	1.005	1.007	1.003	1.000
	6.0	1.005	1.004	1.005	1.002	1.000
	8.0	1.004	1.003	1.004	1.002	1.000

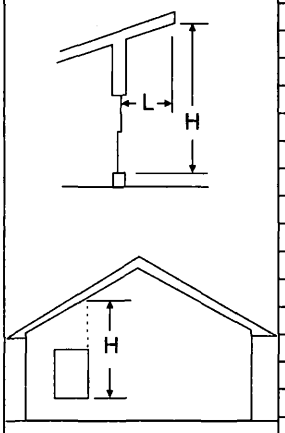
6A-9 COOLING SYSTEM MULTIPLIERS (CSM)

SYSTEM TYPE See Table 13-607.1.ABC.3.2 A,B,D for code minimums		COOLING SYSTEM MULTIPLIERS (CSM)										
Central Units (SEER)	Rating		7.5-7.9	8.0-8.4	8.5-8.8	8.9-9.4	9.5-9.9	10.0-10.4	10.5-10.9	11.0-11.4	11.5-11.9	12.0-12.4
	CSM		.45	.43	.40	.38	.36	.34	.32	.31	.30	.28
PTAC & Room Units (EER)	Rating	12.5-12.9	13.0-13.4	13.5-13.9	14.0-14.4	14.5-14.9	15.0-15.4	15.5-15.9	16.0-16.4	16.5-16.9	17.0-17.4	17.5 & UP
	CSM	.27	.26	.25	.24	.24	.23	.22	.21	.21	.20	.19

WINTER CALCULATIONS

CLIMATE ZONES 4 5 6

GLASS



ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE WINTER POINT MULTIPLIER CLEAR	SINGLE-PANE WINTER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE WINTER POINT MULTIPLIER CLEAR	DOUBLE-PANE WINTER POINT MULTIPLIER TINT[2]	X WINTER OH FACTOR (from 6A-10)	= AS-BUILT GLASS WINTER PTS
N			15.07	15.38	11.00	11.29		
NE			14.70	15.07	10.70	11.04		
E			12.37	13.04	8.82	9.46		
SE			10.59	11.49	7.31	8.18		
S			9.90	10.88	6.74	7.70		
SW			11.59	12.36	8.12	8.86		
W			13.25	13.80	9.55	10.07		
NW			14.97	15.30	10.91	11.21		
[1]H			14.78	15.61	10.20	11.01		

GLASS	.18 X COND. FLOOR AREA	X WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL	AS-BUILT GLASS SUBTOTAL
	.18	9.11		

	COMPONENT DESCRIPTION	AREA	BASE WINTER POINT MULT.	BASE WINTER POINTS	COMPONENT DESCRIPTION	AREA X	WINTER POINT MULT. (6A-11 THRU 6A-15) =	AS-BUILT WINTER POINTS
WALL	EXTERIOR		1.8					
	ADJACENT		1.6					
DOORS	EXTERIOR		5.1					
	ADJACENT		4.0					
CEILING	UNDER ATTIC OR SINGLE ASSEMBLY		0.64					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		2.5					
	RAISED (AREA)		.39					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			-0.28				-0.28	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE WINTER POINTS		TOTAL COMPONENT AS-BUILT WINTER POINTS	

HEATING SYSTEM	Base Heating System Multiplier X	Total Base Winter Points =	BASE HEATING POINTS	TOTAL AS-BUILT WIN. PTS.	As-Built DM X (6A-17)	As-Built DSM X (6A-20)	As Built AHU X (6A-16)	As Built HSM X (6A-18)	As Built HCM X (6A-21) =	AS-BUILT HEATING POINTS
	.554					1.16 or 1.0				

BASE COOLING POINTS (From P. 2) +	BASE HEATING POINTS +	BASE HOT WATER POINTS (From P. 2) =	TOTAL BASE POINTS (Enter on P. 1)	AS-BUILT COOLING POINTS (From P. 2) +	AS-BUILT HEATING POINTS +	AS-BUILT HOT WATER POINTS (From P. 2) =	TOTAL AS-BUILT POINTS (Enter on P. 1)

[1]H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 APPENDIX C. TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3]MUST MEET CRITERIA OF S.607.1A.

WINTER POINT MULTIPLIERS (WPM)

CLIMATE ZONES 4 5 6

6A-10 WINTER OVERHANG FACTORS (WOF)

SELECT BY OR	OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
	North	1.00	0.998	0.996	0.995	0.995	0.994	0.993	0.992	0.990	0.988	1.986	0.984
	Northeast	1.00	1.000	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.000
	East	1.00	1.005	1.010	1.020	1.034	1.055	1.078	1.106	1.133	1.198	1.264	1.320
	Southeast	1.00	1.010	1.025	1.058	1.102	1.167	1.238	1.324	1.407	1.596	1.783	1.939
	South	1.00	0.994	1.011	1.062	1.040	1.262	1.400	1.562	1.709	1.992	2.192	2.291
	Southwest	1.00	1.002	1.013	1.038	1.071	1.118	1.168	1.225	1.278	1.388	1.490	1.573
	West	1.00	0.999	1.003	1.013	1.025	1.040	1.053	1.067	1.077	1.095	1.107	1.116
	Northwest	1.00	0.999	0.998	0.997	0.997	0.996	0.995	0.994	0.993	0.992	0.990	0.989
	OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-11 WALL WINTER POINT MULTIPLIERS (WPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	R-VALUE	WOOD FR	R-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	R-VALUE	EXT	ADJ	EXT	0-6.9	7.0	0-2.9	3.7	R-VALUE	EXT	EXT
0-6.9	6.8	5.3	9.4	6.7	0-2.9	6.0	3.1	6.0	7-10.9	2.1	3-6.9	2.6	0-2.9	2.2	1.2
7-10.9	2.5	2.1	4.4	3.3	3-4.9	3.8	2.3	2.8	11-18.9	1.7	7-9.9	1.8	3-6.9	1.2	.9
11-12.9	2.0	1.8	3.3	2.6	5-6.9	2.9	1.9	2.0	19-25.9	1.0	10 & UP	1.3	7 & UP	.9	.7
13-18.9	1.8	1.6	3.0	2.4	7-10.9	2.3	1.5	1.5	26 & UP	.6					
19-25.9	1.1	1.0	2.6	2.2	11-18.9	1.5	1.1	.8							
26 & UP	.7	.7	1.4	1.2	19-25.9	.8	.7								
					26 &UP	.5	.5								

NOTE: SEE SECTION 2.0 OF APPENDIX C FOR MULTIPLIERS OF ENVELOPE COMPONENTS NOT ON THIS FORM.

6A-12 DOOR WINTER POINT MULTIPLIERS (WPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	7.6	5.9
INSULATED	5.1	4.0

6A-13 CEILING WINTER POINT MULTIPLIERS (WPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
					CEILING TYPE	
R-VALUE	WPM	R-VALUE	WPM	R-VALUE	EXPOSED	DROPPED
19-21.9	.87	10-10.9	1.02	10-13.9	1.16	1.05
22-25.9	.78	11-12.9	.96	14-20.9	.83	.76
26-29.9	.69	13-18.9	.84	21 & UP	.54	.50
30-37.9	.64	19-25.9	.62			
38 & UP	.55	26-29.9	.50			
RBS Credit	0.850	30 & UP	.46			
IRCC Credit	0.905					
White Roof Credit	1.044					

6A-14 FLOOR WINTER POINT MULTIPLIERS (WPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	WPM	R-VALUE	WPM	R-VALUE	WPM	WPM	WPM
0-2.9	2.5	0-2.9	4.0	0-6.9	2.49	1.8	5.3
3-4.9	-1.7	3-4.9	1.8	7-10.9	0.78	.7	2.1
5-6.9	-2.4	5-6.9	1.1	11-18.9	0.47	.5	1.8
7 & UP	-2.7	7 & UP	.8	19 & UP	0.14	.3	1.0

6A-15 INFILTRATION & INTERNAL GAINS (WPM)

Air Infiltration	0.87
Internal Gains	-1.15
Infiltration/Internal Gains (Combined)	-0.28

6A-16 AIR HANDLER MULTIPLIERS (WPM)

Located in garage	1.00
Located in conditioned area	0.92
Located on exterior of building	1.09
Located in attic	1.11

6A-17 DUCT MULTIPLIERS (DM) See Table 13-610.1.ABC.2.1 for Code minimums.

SUPPLY DUCTS IN:	DUCT R-VALUE	RETURN DUCTS In:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.107	1.098	1.100	1.102	1.092
	6.0	1.078	1.072	1.074	1.075	1.068
	8.0	1.061	1.056	1.057	1.058	1.052
Attic/Radiant Barrier (RBS)	4.2	1.076	1.067	—	—	1.059
	6.0	1.058	1.051	—	—	1.045
	8.0	1.046	1.041	—	—	1.036
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.097	—	1.088	—	1.077
	6.0	1.073	—	1.066	—	1.057
	8.0	1.057	—	1.052	—	1.045
Attic/Cool Roof	4.2	1.120	—	—	1.110	1.095
	6.0	1.088	—	—	1.081	1.070
	8.0	1.068	—	—	1.063	1.054
Conditioned Space	4.2	1.009	1.008	1.010	1.009	1.000
	6.0	1.007	1.006	1.007	1.007	1.000
	8.0	1.005	1.005	1.006	1.005	1.000

6A-18 HEATING SYSTEM MULTIPLIERS (HSM) All Climate Zones

SYSTEM TYPE See Table N1108.ABC.3.2 B for code minimums		HEATING SYSTEM MULTIPLIERS (HSM)							
Central Heat Pump Units	HSPF	7.4-7.6	7.7-7.8	7.9-8.3	8.4-8.8	8.9-9.3	9.4-9.8	9.9-10.3	10.4-10.8
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
PTHP	COP	2.50-1.69	2.70-2.89	2.90-3.09	3.10-3.29	3.30-3.49	3.50-3.69	3.70-3.89	3.90-4.19
	HSM	.40	.37	.34	.32	.30	.29	.27	.26
Gas Heating	AFUE	76-.77	.78	.79-.82	.83-.85	.86-.89	.90-.92	.93-.95	.96-.98
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
Electric Strip		1.0							

ADDITIONAL TABLES

CLIMATE ZONES 4 5 6

6A-19 COOLING CREDIT MULTIPLIERS

SYSTEM TYPE	Cooling credit multipliers (CCM)
Ceiling Fans	.95*
Cross Ventilation	.95*
Whole House Fan	.95*
Multizone	.95
Programmable Thermostat	.95

*Credit may be taken for only one system type concurrently.

6A-20 AIR DISTRIBUTION SYSTEM CREDIT MULTIPLIERS

TYPE CREDIT	Prescriptive requirements	Multiplier
Air-tight Duct Credit[1]	Appx G-C5.2.2.1.1	1.00
Factory-sealed AHU Credit[2]	Appx G-C5.2.2.1.2	0.95

[1]Duct Sealing Multiplier (DSM) shall be 1.15 (summer) or 1.16 (winter) unless Air-tight Duct Credit is demonstrated by test report.

[2]Multiply Factory-sealed AHU Credit by summer (Table 6A-7) or winter (Table 6A-16) AHU multiplier. Insert total in the "As Built AHU" box on page 2 or 4.

6A-21 HEATING CREDIT MULTIPLIERS (HCM)

SYSTEM TYPE		HEATING CREDIT MULTIPLIERS (HCM)
Programmable Thermostat	HCM	.95
Multizone	HCM	.95

6A-22 HOT WATER MULTIPLIERS (HWM)

SYSTEM TYPE See Table N1112.ABC.3.2 for code minimums									
Electric Resistance	EF	.80-.81	.82-.83	.84-.85	.86-.87	.88-.90	.91-.93	.94-.96	.97 &Up
	HWM	2820	2752	2685	2624	2564	2479	2400	2326
Gas Water Heating	EF	.54	.55	.56	.57	.58	.59	.60	.61
	HWM	2820	2752	2685	2624	2564	2479	2400	2326
	EF	.62-.63	.64-.65	.66-.70	.71-.75	.76-.80	.81-.83	.84-.86	.87 & Up
	HWM	2191	2070	1962	1623	1359	1117	985	871

6A-23 HOT WATER CREDIT MULTIPLIERS (HWCM)

SYSTEM TYPE		HOT WATER CREDIT MULTIPLIERS (HWCM)				
Heat Recovery Unit	With	Air Conditioner		Heat Pump		
	HWCM	.84		.78		
Add-on Dedicated Heat Pump (without tank)	EF	2.0-2.49	2.5-2.99	3.0-3.49	3.5 & Up	
	HWCM	.44	.35	.29	.25	
Add-on Solar Water Heater (without tank)	EF	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0 & Up
	HWCM	.84	.42	.28	.21	.17

NOTE: An HWM must be used in conjunction with all HWCM. See Table 6A-22. EF Means Energy Factor.

6A-24 INFILTRATION REDUCTION COMPLIANCE CHECKLIST

COMPONENTS	SECTION	REQUIREMENTS FOR EACH PRACTICE	CHECK
Exterior Windows & Doors	N1106.ABC.1.1	Max: 3 cfm/sq. ft. window area; .5cfm/sq. ft. door area.	
Exterior & Adjacent Walls	N1106.ABC.1.2.1	Caulk, gasket, weatherstrip or seal between: windows/doors & frames, surrounding wall; foundation & wall sole or sill plate; joints between exterior wall panels at corners; utility penetrations; between wall panels & top/bottom plates; between walls & floor. EXCEPTION: Frame walls where a continous infiltration barrier is installed that extends from, and is sealed to, the foundation to the top plate.	
Floors	N1106.ABC.1.2.2	Penetrations/openings >1/8" sealed unless backed by truss or joint members. EXCEPTION: Frame floors where a continuous infiltration barrier is installed that is sealed to the perimeter, penetrations and seams.	
Ceilings	N1106.ABC.1.2.3	Seal: Between walls & ceilings: penetrations of ceiling plane of top floor; around shafts, chases, soffits, chimneys, cabinets sealed to continuous air barrier; gaps in gyp board & top plate; attic access. EXCEPTION: Frame ceilings where a continuous infiltration barrier is installed that is sealed at the perimeter, at penetrations and seams.	
Recessed Lighting Fixtures	N1106.ABC.1.2.4	Type IC rated with no penetrations, sealed; or Type IC or non-IC rated, installed inside a sealed box with 1/2" clearance & 3" from insulation; or Type IC rated with <2.0 cfm from conditioned space, tested.	
Multiple Story Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Additional Infiltration reqts	N1106.ABC.1.3	Exhaust fans vented to outdoors, dampers; combustion space heaters comply with NFPA, have combustion air.	

6A-25 OTHER PRESCRIPTIVE MEASURES (must be met or exceeded by all residences.)

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker (electric) or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Non-commercial pools must have a pump timer. Gas spa & pool heaters must have a minimum thermal efficiency of 78%.	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 PSIG.	
Air Distribution Systems	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated, and installed in accordance with the criteria of Section N1110. Ducts in unconditioned attics: R-6 minimum insulation.	
HVAC Controls	N1104.ABC.1 N1102.BC.1.1	Separate readily accessible manual or automatic thermostat for each system.	

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 600A-07 — **Alternate Residential Points System Method** — **SOUTH 7 8 9**

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 4 ☐ 5 ☐ 6 ☐
OWNER:		**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

		Please Type	CK
1.	**New construction or addition**	1. _____	
2.	**Single-family detached or Multiple-family attached**	2. _____	
3.	**If Multiple-family–No. of units covered by this submission**	3. _____	
4.	**Is this a worst case? (yes/no)**	4. _____	
5.	**Conditioned floor area (sq. ft.)**	5. _____ sq. ft.	
6.	**Predominant eave overhang (ft.)**	6. _____ ft.	
7.	**Glass type[1] and area: (Label required by 13-104.4.5 if not default)**	Description Area	
	a. *U*-factor: (or Single- or Double-Pane DEFAULT)	7a. _____ _____ sq. ft.	
	b. SHGC: (or Clear or Tint DEFAULT)	7b. _____ _____ sq. ft.	
8.	**Floor type and insulation:**		
	a. Slab-on-grade (*R*-value + perimeter)	8a. R =_____ , _____ l. ft.	
	b. Wood, raised (*R*-value + sq. ft.)	8b. R =_____ , _____ sq. ft.	
	c. Concrete, raised (*R*-value)	8c. R =_____ , _____ sq. ft.	
9.	**Net Wall type, area and insulation:**		
	a. Exterior: 1. Concrete block (Insulation *R*-value)	9a-1 R = _____ , _____ sq. ft.	
	2. Wood frame (Insulation *R*-value)	9a-2 R = _____ , _____ sq. ft.	
	3. Steel frame (Insulation *R*-value)	9a-3 R = _____ , _____ sq. ft.	
	4. Log (Insulation *R*-value)	9a-4 R = _____ , _____ sq. ft.	
	5. Other:_____		
	b. Adjacent: 1. Concrete block (Insulation *R*-value)	9b-1 R = _____ , _____ sq. ft.	
	2. Wood frame (Insulation *R*-value)	9b-2 R = _____ , _____ sq. ft.	
	3. Steel frame (Insulation *R*-value)	9b-3 R = _____ , _____ sq. ft.	
	4. Log (Insulation *R*-value)	9b-4 R = _____ , _____ sq. ft.	
10.	**Ceiling type, area and insulation:**		
	a. Under attic (Insulation *R*-value)	10a. _____ _____ sq. ft.	
	b. Single assembly (Insulation *R*-value)	10b. _____ _____ sq. ft.	
	c. Radiant barrier, IRCC or white roof installed?	10c. _____	
11.	**Air distribution system:**		
	a. Ducts (Insulation + Location)	11a. R = _____ , _____ (cond./uncond.)	
	b. Air Handler (Location)	11b. R = _____ , _____ (cond./uncond.)	
12.	**Cooling system:**	12a. Type: _____	
	(Types: central-split, central-single pkg., room unit, PTAC, gas, none)	12b. SEER/EER/COP: _____	
		12c. Capacity: _____	
13.	**Heating system:**	13a. Type: _____	
	(Types: heat pump, elec. strip, nat. gas, LP Gas, gas h.p., room or PTAC, none)	13b. HSPF/COP/AFUE: _____	
		13c. Capacity: _____	
14.	**Hot water system:**	14a.Type: _____	
	(Types: elec., natural gas, solar, LP gas, none)	14b. EF: _____	
15.	**Hot water credits**	15a. _____	
	a. Heat Recovery (HR)	15b. _____	
	b. Dedicated Heat Pump (DHP)	15c. _____	
	c. Solar		
16.	**HVAC credits**	16. _____	
	(Use: CF-Ceiling Fan, CV-cross vent, PT-programmable thermostat, HF-whole house fan, MZ-Multizone)		
17.	**COMPLIANCE STATUS:** (PASS if As-Built Pts. Are less than Base Pts.)	17. _____	
	a. Total As-Built Points b. Total Base Points	17a._____17b. _____	

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY:_____ **DATE:**_____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:**_____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

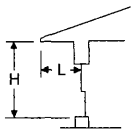
DATE: _____

[1] Predominant glass type. For actual glass type and areas, see summer and winter glass output on Pages 2 and 4.

SUMMER CALCULATIONS

CLIMATE ZONES 7 8 9

GLASS	ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE SUMMER POINT MULTIPLIER CLEAR	SINGLE-PANE SUMMER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE SUMMER POINT MULTIPLIER CLEAR	DOUBLE-PANE SUMMER POINT MULTIPLIER TINT[2] X	SUMMER OH FACTOR (from 6A-1)	= AS-BUILT GLASS SUMMER PTS
	N			36.46	29.33	31.93	24.93		
	NE			55.61	45.70	48.54	38.79		
	E			78.71	65.40	68.60	55.50		
	SE			79.81	66.34	69.60	56.34		
	S			66.93	55.34	58.45	47.06		
	SW			73.41	60.87	64.05	51.71		
	W			70.53	58.39	61.59	49.65		
	NW			48.42	39.52	42.35	33.62		
	H[1]			133.72	109.20	118.14	93.98		



OVERHANG RATIO = OH LENGTH / OH HEIGHT

GLASS	.18 X	COND. FLOOR AREA X	WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL	AS-BUILT GLASS SUBTOTAL
	.18		30.53		

	COMPONENT DESCRIPTION	AREA X	BASE SUMMER POINT MULT	= BASE SUMMER POINTS	COMPONENT DESCRIPTION	AREA	SUMMER POINT MULT. (6A-2 THRU 6A-6)	= AS-BUILT SUMMER POINTS
WALL	EXTERIOR		2.4					
	ADJACENT		.9					
DOORS	EXTERIOR		6.4					
	ADJACENT		2.6					
CEILING	UNDER ATTIC OR SINGLE ASSEMBLY		2.8					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		-20.0					
	RAISED (AREA)		1.96					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			18.79				18.79	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE SUMMER POINTS		TOTAL COMPONENT AS-BUILT SUMMER POINTS	

	Base Cooling System Multiplier X	Total Base Summer Points	= BASE COOLING POINTS	TOTAL AS-BUILT SUM. PTS. X	As-Built DM (6A-8) X	As-Built DSM (6A-20) X	As-Built AHU (6A-7) X	As-Built CSM (6A-9) X	As-Built CCM (6A-19) =	AS-BUILT COOLING POINTS
COOLING SYSTEM	.325					1.16 or 1.0				

	Number of Bedrooms X	Base Hot Water Multiplier	= BASE HOT WATER POINTS	AS-BUILT HOT WATER SYSTEM DESC.	Number of Bedrooms X	As-Built HWM (6A-22) X	As-Built HWCM (6A-23) =	AS-BUILT HOT WATER POINTS
HOT WATER SYSTEM		2273						

[1] H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 APPENDIX C. TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3] MUST MEET CRITERIA OF S.607.1.A.

SUMMER POINT MULTIPLIERS (SPM)

CLIMATE ZONES 7 8 9

6A-1 SUMMER OVERHANG FACTORS (SOF) FOR SINGLE AND DOUBLE-PANE GLASS

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.993	0.971	0.932	0.891	0.847	0.810	0.774	0.745	0.692	0.646	0.606
Northeast	1.00	0.995	0.966	0.909	0.849	0.782	0.726	0.673	0.633	0.561	0.504	0.459
East	1.00	0.993	0.964	0.904	0.837	0.759	0.691	0.625	0.574	0.484	0.415	0.462
Southeast	1.00	0.999	0.960	0.881	0.799	0.713	0.645	0.585	0.542	0.471	0.422	0.386
South	1.00	0.995	0.945	0.854	0.770	0.689	0.630	0.581	0.546	0.592	0.455	0.428
Southwest	1.00	0.997	0.958	0.882	0.805	0.723	0.657	0.599	0.555	0.482	0.427	0.386
West	1.00	0.994	0.965	0.905	0.840	0.767	0.704	0.645	0.599	0.518	0.455	0.404
Northwest	1.00	0.995	0.967	0.914	0.861	0.805	0.760	0.718	0.686	0.629	0.583	0.545
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-2 WALL SUMMER POINT MULTIPLIERS (SPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	*R*-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT	0-6.9	4.6	0-2.9	2.3			
0-6.9	8.5	3.4	11.6	4.4	0-2.9	4.2	1.9	4.2	7-10.9	1.3	3-6.9	1.6	*R*-VALUE	EXT	EXT
7-10.9	3.2	1.3	5.5	2.1	3-4.9	2.7	1.3	1.7	11-18.9	1.1	7-9.9	.9	0-2.9	2.8	1.9
11-12.9	2.7	1.0	4.2	1.6	5-6.9	2.0	1.1	1.2	19-25.9	.6	10 & UP	.7	3-6.9	1.9	1.4
13-18.9	2.4	.9	3.9	1.5	7-10.9	1.6	.8	.7	26 & UP	.3			7 & UP	1.5	1.2
19-25.9	1.6	.6	3.4	1.3	11-18.9	1.0	.6	.3							
26 & UP	1.0	.3	1.9	.7	19-25.9	.5	.3								
					26 & Up	.3	.2								

NOTE: SEE SECTION 2.0 OF APPENDIX C FOR MULTIPLIERS OF ENVELOPE COMPONENTS NOT ON THIS FORM.

6A-3 DOOR SUMMER POINT MULTIPLIERS (SPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	9.4	3.8
INSULATED	6.4	2.6

6A-4 CEILING SUMMER POINT MULTIPLIERS (SPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
					CEILING TYPE	
R-VALUE	SPM	R-VALUE	SPM	*R*-VALUE	EXPOSED	DROPPED
19-21.9	3.72	10-10.9	13.67	10-13.9	14.73	13.67
22-25.9	3.36	11-12.9	12.90	14-20.9	10.96	10.46
26-29.9	3.02	13-18.9	11.59	21 & UP	7.86	7.54
30-37.9	2.77	19-25.9	9.24			
38 & UP	2.43	26-29.9	7.85			
RBS Credit	0.700	30 & Up	7.27			
IRCC Credit	0.865					
White Roof Credit	0.550					

6A-5 FLOOR SUMMER POINT MULTIPLIERS (SPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	SPM	*R*-VALUE	SPM	*R*-VALUE	SPM	SPM	SPM
0-2.9	-20.0	0-2.9	.8	0-6.9	5.02	-4.2	3.4
3-4.9	-17.4	3-4.9	-.3	7-10.9	2.58	-.9	1.3
5-6.9	-16.6	5-6.9	-.4	11-18.9	2.08	-.6	1.0
7 & UP	-16.0	7 & UP	-.5	19 & UP	1.58	-.4	.6

6A-6 INFILTRATION & INTERNAL GAINS (SPM)

Air Infiltration	7.43
Internal Gains	+11.36
Infiltration/Internal Gains (Combined)	18.79

6A-7 AIR HANDLER MULTIPLIERS (SPM)

Located in garage	1.00
Located in conditioned area	0.90
Located on exterior of building	1.03
Located in attic	1.08

6A-8 DUCT MULTIPLIERS (DM) See Table 13-610.1.ABC.2.1 for Code minimums.

SUPPLY DUCTS IN:	DUCT *R*-VALUE	RETURN DUCTS In:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.095	1.090	1.091	1.090	1.087
	6.0	1.073	1.069	1.070	1.069	1.067
	8.0	1.058	1.055	1.055	1.055	1.053
Attic/Radiant Barrier (RBS)	4.2	1.062	1.057	—	—	1.053
	6.0	1.048	1.044	—	—	1.041
	8.0	1.039	1.036	—	—	1.033
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.083	—	1.078	—	1.072
	6.0	1.064	—	1.061	—	1.056
	8.0	1.052	—	1.049	—	1.045
Attic/Cool Roof	4.2	1.059	—	—	1.054	1.051
	6.0	1.045	—	—	1.041	1.038
	8.0	1.035	—	—	1.032	1.030
Conditioned Space	4.2	1.005	1.004	1.006	1.002	1.000
	6.0	1.004	1.003	1.004	1.002	1.000
	8.0	1.003	1.003	1.003	1.001	1.000

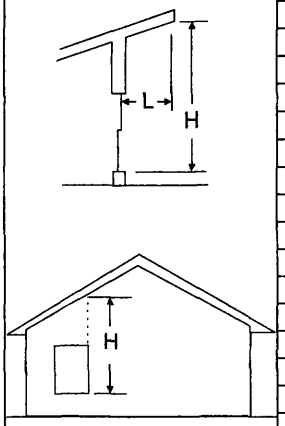
6A-9 COOLING SYSTEM MULTIPLIERS (CSM)

SYSTEM TYPE See Table 13-607.1.ABC.3.2 A,B,D for code minimums		COOLING SYSTEM MULTIPLIERS (CSM)										
Central Units (SEER)	Rating		7.5-7.9	8.0-8.4	8.5-8.8	8.9-9.4	9.5-9.9	10.0-10.4	10.5-10.9	11.0-11.4	11.5-11.9	12.0-12.4
	CSM		.45	.43	.40	.38	.36	.34	.32	.31	.30	.28
PTAC & Room Units (EER)	Rating	12.5-12.9	13.0-13.4	13.5-13.9	14.0-14.4	14.5-14.9	15.0-15.4	15.5-15.9	16.0-16.4	16.5-16.9	17.0-17.4	17.5 & UP
	CSM	.27	.26	.25	.24	.24	.23	.22	.21	.21	.20	.19

WINTER CALCULATIONS

CLIMATE ZONES 7 8 9

GLASS



ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE WINTER POINT MULTIPLIER CLEAR	SINGLE-PANE WINTER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE WINTER POINT MULTIPLIER CLEAR	DOUBLE-PANE WINTER POINT MULTIPLIER TINT[2]	X WINTER OH FACTOR (from 6A-10) =	AS-BUILT GLASS WINTER PTS
N			6.03	6.11	4.38	4.45		
NE			5.84	5.96	4.18	4.28		
E			4.77	5.05	3.30	3.56		
SE			4.22	4.57	2.87	3.20		
S			4.49	4.79	3.12	3.40		
SW			5.06	5.25	3.63	3.83		
W			5.49	5.65	3.98	4.12		
NW			6.00	6.09	4.35	4.43		
[1]H			6.39	6.61	4.48	4.70		

GLASS	.18 X COND. FLOOR AREA X	WEIGHTED GLASS MULTIPLIER =	BASE GLASS SUBTOTAL
	.18	3.60	

AS-BUILT GLASS SUBTOTAL

	COMPONENT DESCRIPTION	AREA	BASE WINTER POINT MULT.	BASE WINTER POINTS	COMPONENT DESCRIPTION	AREA X	WINTER POINT MULT. (6A-11 THRU 6A-15) =	AS-BUILT WINTER POINTS
WALL	EXTERIOR		.6					
	ADJACENT		.5					
DOORS	EXTERIOR		1.8					
	ADJACENT		1.3					
CEILING	UNDER ATTIC OR SINGLE ASSEMBLY		.1					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		-2.1					
	RAISED (AREA)		.09					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			-0.06				-0.06	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE WINTER POINTS		TOTAL COMPONENT AS-BUILT WINTER POINTS	

HEATING SYSTEM	Base Heating System Multiplier X	Total Base Winter Points =	BASE HEATING POINTS
	.554		

TOTAL AS-BUILT WIN. PTS.	As-Built DM X (6A-17)	As-Built DSM X (6A-20)	As Built AHU X (6A-16)	As Built HSM X (6A-18)	As Built HCM = (6A-21)	AS-BUILT HEATING POINTS
		1.14 or 1.0				

TOTAL	BASE COOLING POINTS (From P. 2) +	BASE HEATING POINTS +	BASE HOT WATER POINTS (From P. 2) =	TOTAL BASE POINTS (Enter on P. 1)

AS-BUILT COOLING POINTS (From P. 2) +	AS-BUILT HEATING POINTS +	AS-BUILT HOT WATER POINTS (From P. 2) =	TOTAL AS-BUILT POINTS (Enter on P. 1)

[1]H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 APPENDIX C. TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3]MUST MEET CRITERIA OF S.607.1A.

WINTER POINT MULTIPLIERS (WPM)

CLIMATE ZONES 7 8 9

6A-10 WINTER OVERHANG FACTORS (WOF)

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.998	0.995	0.991	0.986	0.982	0.977	0.973	0.969	0.962	0.955	0.984
Northeast	1.00	0.999	0.999	0.998	0.997	0.996	0.994	0.993	0.991	0.985	0.978	0.969
East	1.00	1.009	1.015	1.023	1.032	1.044	1.057	1.073	1.090	1.136	1.203	1.291
Southeast	1.00	1.017	1.027	1.046	1.067	1.097	1.130	1.171	1.215	1.333	1.485	1.647
South	1.00	0.994	1.001	1.024	1.060	1.115	1.174	1.238	1.290	1.376	1.425	1.443
Southwest	1.00	0.999	1.003	1.012	1.024	1.041	1.059	1.078	1.096	1.132	1.164	1.191
West	1.00	0.998	0.998	0.999	1.001	1.005	1.011	1.018	1.023	1.030	1.032	1.032
Northwest	1.00	0.997	0.995	0.992	0.989	0.985	0.982	0.978	0.974	0.967	0.959	0.952
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-11 WALL WINTER POINT MULTIPLIERS (WPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	R-VALUE	WOOD FR	R-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	R-VALUE	EXT	ADJ	EXT	0-6.9	2.4	0-2.9	.9	R-VALUE	EXT	EXT
0-6.9	2.5	1.7	3.4	2.2	0-2.9	1.9	.7	1.9	7-10.9	.6	3-6.9	.6	0-2.9	.6	.2
7-10.9	.8	.6	1.5	1.0	3-4.9	1.2	.5	.6	11-18.9	.5	7-9.9	.4	3-6.9	.3	.1
11-12.9	.6	.5	1.1	0.8	5-6.9	.9	.4	.3	19-25.9	.2	10 & UP	.2	7 & UP	.2	.1
13-18.9	.6	.5	1.0	0.7	7-10.9	.7	.4	.2	26 & UP	.1					
19-25.9	.3	.3	0.9	0.6	11-18.9	.4	.2	.0							
26 & UP	.2	.2	0.4	0.3	19-25.9	.2	.1								
					26 &UP	.1	.0								

NOTE: SEE SECTION 2.0 OF APPENDIX C FOR MULTIPLIERS OF ENVELOPE COMPONENTS NOT ON THIS FORM.

6A-12 DOOR WINTER POINT MULTIPLIERS (WPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	2.8	1.9
INSULATED	1.8	1.3

6A-13 CEILING WINTER POINT MULTIPLIERS (WPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
					CEILING TYPE	
R-VALUE	WPM	R-VALUE	WPM	R-VALUE	EXPOSED	DROPPED
19-21.9	.14	10-10.9	.16	10-13.9	0.18	0.16
22-25.9	.12	11-12.9	.15	14-20.9	0.13	0.12
26-29.9	.11	13-18.9	.14	21 & UP	0.09	0.08
30-37.9	.10	19-25.9	.11			
38 & UP	.08	26-29.9	.09			
RBS Credit	0.850	30 & UP	.08			
IRCC Credit	0.899					
White Roof Credit	1.044					

6A-14 FLOOR WINTER POINT MULTIPLIERS (WPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	WPM	R-VALUE	WPM	R-VALUE	WPM	WPM	WPM
0-2.9	-2.1	0-2.9	1.0	0-6.9	0.99	0.3	1.7
3-4.9	-2.6	3-4.9	.3	7-10.9	0.24	0	.6
5-6.9	-2.7	5-6.9	.1	11-18.9	0.12	0	.5
7 & UP	-2.7	7 & UP	0	19 & UP	-0.01	-.1	.3

6A-15 INFILTRATION & INTERNAL GAINS (WPM)

Air Infiltration	0.87
Internal Gains	-1.15
Infiltration/Internal Gains (Combined)	-0.28

6A-16 AIR HANDLER MULTIPLIERS (WPM)

Located in garage	1.00
Located in conditioned area	0.92
Located on exterior of building	1.09
Located in attic	1.11

6A-17 DUCT MULTIPLIERS (DM) See Table 13-610.1.ABC.2.1 for Code minimums.

SUPPLY DUCTS IN:	DUCT R-VALUE	RETURN DUCTS In:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.135	1.123	1.125	1.128	1.116
	6.0	1.099	1.091	1.092	1.094	1.085
	8.0	1.076	1.070	1.071	1.073	1.066
Attic/Radiant Barrier (RBS)	4.2	1.095	1.083	—	—	1.073
	6.0	1.072	1.063	—	—	1.056
	8.0	1.057	1.050	—	—	1.044
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.122	—	1.110	—	1.096
	6.0	1.091	—	1.083	—	1.072
	8.0	1.071	—	1.0565	—	1.056
Attic/Cool Roof	4.2	1.151	—	—	1.139	1.120
	6.0	1.111	—	—	1.102	1.088
	8.0	1.085	—	—	1.078	1.068
Conditioned Space	4.2	1.012	1.010	1.012	1.012	1.000
	6.0	1.009	1.008	1.009	1.009	1.000
	8.0	1.007	1.006	1.007	1.007	1.000

6A-18 HEATING SYSTEM MULTIPLIERS (HSM) All Climate Zones

SYSTEM TYPE See Table N1108.ABC.3.2 B for code minimums		HEATING SYSTEM MULTIPLIERS (HSM)							
Central Heat Pump Units	HSPF	7.4-7.6	7.7-7.8	7.9-8.3	8.4-8.8	8.9-9.3	9.4-9.8	9.9-10.3	10.4-10.8
	HSM	46	44	43	41	38	36	34	33
PTHP	COP	2.50-1.69	2.70-2.89	2.90-3.09	3.10-3.29	3.30-3.49	3.50-3.69	3.70-3.89	3.90-4.19
	HSM	40	37	34	32	30	29	27	26
Gas Heating	AFUE	76- 77	78	79- 82	83- 85	86- 89	90- 92	93- 95	96- 98
	HSM	46	44	43	41	38	36	34	33
Electric Strip		1.0							

ADDITIONAL TABLES

CLIMATE ZONES 7 8 9

6A-19 COOLING CREDIT MULTIPLIERS

SYSTEM TYPE	Cooling credit multipliers (CCM)
Ceiling Fans	.95*
Cross Ventilation	.95*
Whole House Fan	.95*
Multizone	.95
Programmable Thermostat	.95

*Credit may be taken for only one system type concurrently.

6A-20 AIR DISTRIBUTION SYSTEM CREDIT MULTIPLIERS

TYPE CREDIT	Prescriptive requirements	Multiplier
Air-tight Duct Credit[1]	Appx G-C5.2.2.1.1	1.00
Factory-sealed AHU Credit[2]	Appx G-C5.2.2.1.2	0.95

[1]Duct Sealing Multiplier (DSM) shall be 1.15 (summer) or 1.16 (winter) unless Air-tight Duct Credit is demonstrated by test report.
[2]Multiply Factory-sealed AHU Credit by summer (Table 6A-7) or winter (Table 6A-16) AHU multiplier. Insert total in the "As Built AHU" box on page 2 or 4.

6A-21 HEATING CREDIT MULTIPLIERS (HCM)

SYSTEM TYPE		HEATING CREDIT MULTIPLIERS (HCM)
Programmable Thermostat	HCM	.95
Multizone	HCM	.95

6A-22 HOT WATER MULTIPLIERS (HWM)

SYSTEM TYPE See Table N1112.ABC.3.2 for code minimums									
Electric Resistance	EF	.80-.81	.82-.83	.84-.85	.86-.87	.88-.90	.91-.93	.94-.96	.97 &Up
	HWM	2606	2543	2482	2424	2369	2290	2218	2149
Gas Water Heating	EF	.54	.55	.56	.57	.58	.59	.60	.61
	HWM	2606	2543	2482	2424	2369	2290	2218	2149
	EF	.62-.63	.64-.65	.66-.70	.71-.75	.76-.80	.81-.83	.84-.86	.87 & Up
	HWM	2024	1912	1813	1500	1256	1032	910	805

6A-23 HOT WATER CREDIT MULTIPLIERS (HWCM)

SYSTEM TYPE		HOT WATER CREDIT MULTIPLIERS (HWCM)				
Heat Recovery Unit	With	Air Conditioner		Heat Pump		
	HWCM	.84		.78		
Add-on Dedicated Heat Pump (without tank)	EF	2.0-2.49	2.5-2.99	3.0-3.49	3.5 & Up	
	HWCM	.44	.35	.29	.25	
Add-on Solar Water Heater (without tank)	EF	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0 & Up
	HWCM	.84	.42	.28	.21	.17

NOTE: An HWM must be used in conjunction with all HWCM. See Table 6A-22. EF Means Energy Factor.

6A-24 INFILTRATION REDUCTION COMPLIANCE CHECKLIST

COMPONENTS	SECTION	REQUIREMENTS FOR EACH PRACTICE	CHECK
Exterior Windows & Doors	N1106.ABC.1.1	Max: 3 cfm/sq. ft. window area; .5cfm/sq. ft. door area.	
Exterior & Adjacent Walls	N1106.ABC.1.2.1	Caulk, gasket, weatherstrip or seal between: windows/doors & frames, surrounding wall; foundation & wall sole or sill plate; joints between exterior wall panels at corners; utility penetrations; between wall panels & top/bottom plates; between walls & floor. EXCEPTION: Frame walls where a continous infiltration barrier is installed that extends from, and is sealed to, the foundation to the top plate.	
Floors	N1106.ABC.1.2.2	Penetrations/openings >1/8" sealed unless backed by truss or joint members. EXCEPTION: Frame floors where a continuous infiltration barrier is installed that is sealed to the perimeter, penetrations and seams.	
Ceilings	N1106.ABC.1.2.3	Seal: Between walls & ceilings: penetrations of ceiling plane of top floor; around shafts, chases, soffits, chimneys, cabinets sealed to continuous air barrier; gaps in gyp board & top plate; attic access. EXCEPTION: Frame ceilings where a continuous infiltration barrier is installed that is sealed at the perimeter, at penetrations and seams.	
Recessed Lighting Fixtures	N1106.ABC.1.2.4	Type IC rated with no penetrations, sealed; or Type IC or non-IC rated, installed inside a sealed box with 1/2" clearance & 3" from insulation; or Type IC rated with <2.0 cfm from conditioned space, tested.	
Multiple Story Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Additional Infiltration reqts	N1106.ABC.1.3	Exhaust fans vented to outdoors, dampers; combustion space heaters comply with NFPA, have combustion air.	

6A-25 OTHER PRESCRIPTIVE MEASURES (must be met or exceeded by all residences.)

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker (electric) or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Non-commercial pools must have a pump timer. Gas spa & pool heaters must have a minimum thermal efficiency of 78%.	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 PSIG.	
Air Distribution Systems	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated, and installed in accordance with the criteria of Section N1110. Ducts in unconditioned attics: R-6 minimum insulation.	
HVAC Controls	N1107.ABC.2	Separate readily accessible manual or automatic thermostat for each system.	
Insulation	N1104.ABC.1 N1102.BC.1.1	Ceilings–Min. R-19. Common walls–Frame R-11 or CBS R-3 both sides. Common ceiling & floors R-11.	

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 1100B-07 — **Residential Component Prescriptive Method B** — **NORTH 1 2 3**

Compliance with Method B of Chapter 11 of the Florida Building Code, Residential may be demonstrated by the use of Form 1100B for single-and multiple-family residences of three stories or less in height, and additions to existing residential buildings. To comply, a building must meet or exceed all of the energy efficiency prescriptives in any one of the prescriptive component packages and comply with the prescriptives listed in this form. An alternative method is provided for additions of 600 square feet or less by use of Form 1100C. If a building does not comply with this method, it may still comply under other sections in Chapter 11 of the code.

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 1 ☐ 2 ☐ 3 ☐
OWNER:		**PERMIT NO.:**	**JURISDICTION NO.:**

1. New construction including additions which incorporate any of the following features cannot comply using this method: skylights or other nonvertical roof glass, glass area in excess of 16 percent of conditioned floor area, and electric resistance heat.
2. Fill in all the applicable spaces of the "To Be Installed" column on Table 11B-1 with the information requested. All "To Be Installed" values must be equal to or more efficient than the required levels.
3. Complete page 1 based on the "To Be Installed" column information.
4. Read "Minimum Requirements for All Packages, Table 11B-2 and check each box to indicate your intent to comply with all applicable items.
5. Read, sign and date the "Prepared By" certification statement at the bottom of page 1. The owner or owner's agent must also sign and date the form.

	Please Print	CK
1. New construction or addition	1. _____	____
2. Single-family detached or multiple-family attached	2. _____	____
3. If multiple-family–No. of units covered by this submission	3. _____	____
4. Is this a worst case? (yes/no)	4. _____	____
5. Conditioned floor area (sq. ft.)	5. _____	____
		____
6. Glass type and area:		
a. U-factor	6a. _____	____
b. SHGC	6b. _____	
c. Glass area	6c. _____ sq. ft.	____
7. Percentage of glass to floor area	7. _____ %	____
		____
8. Floor type, area or perimeter, and insulation:		
a. Slab-on-grade (*R*-value)	8a R =_____ _____ lin. ft.	____
b. Wood, raised (*R*-value)	8b. R =_____ _____ sq. ft.	____
c. Wood, common (*R*-value)	8c. R =_____ _____ sq. ft.	____
d. Concrete, raised (*R*-value)	8d. R =_____ _____ sq. ft.	____
e. Concrete, common (*R*-value)	8e. R =_____ _____ sq. Ft.	____
9. Wall type, area and insulation:		
a. Exterior: 1. Masonry (Insulation R-value)	9a-1 R =_____ _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9a-2 R =_____ _____ sq. ft.	____
b. Adjacent: 1. Masonry (Insulation *R*-value)	9b-1 R =_____ _____ sq. ft.	____
2. Wood frame (Insulation *R*-value)	9b-2 R =_____ _____ sq. ft.	____
		____
10. Ceiling type, area and insulation:		____
a. Under attic (Insulation *R*-value)	10a. R =_____ sq. ft._____	
b. Single assembly (Insulation *R*-value)	10b. R =_____ _____ sq. ft.	
11. Air distribution system: Duct insulation, location	11. R =_____ _____	____
		____
12. Cooling system:	12a. Type: _____	____
(Types: central, room unit, package terminal A.C., gas, none)	12b. SEER/EER: _____	
	12c. Capacity: _____	____
13. Heating system:	13a. Type: _____	____
(Types: heat pump, elec. strip, nat. gas, LP-Gas, gas h.p., room or PTAC, none)	13b. HSPF/COP/AFUE: _____	____
	13c. Capacity: _____	____
14. Hot water system:	14a. Type: _____	____
(Types: elec., nat. gas, LP-gas, solar, heat rec., ded. heat pump, other, none)	14b. EF: _____	____
		____
		____

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

DATE: _____

TABLE 11B-1 MINIMUM REQUIREMENTS Climate Zones 1 2 3

BUILDING COMPONENT	PERFORMANCE CRITERIA	INSTALLED VALUES:
Windows (see Note 2):	U-Factor = 0.75 SHGC = 0.40 % of CFA < = 16%	U-Factor = SHGC = % of CFA =
Exterior door type	Wood or insulated	Type:
Walls – Ext. and Adj. (see Note 3): Frame Mass Interior: Exterior:	 R-13 R-6 R-4	 R-Value = R-Value = R-Value =
Ceilings (see Notes 3 & 4)	R=30	R-Value =
Floors: Slab-on-grade Over unconditioned spaces (see Note 3)	No requirement R-13	R-Value =
Hot water systems (storage type) Electric (see Note 5): Natural gas (see Note 6):	 40 gal: EF = 0.92 50 gal: EF = 0.90 40 gal: EF = 0.59 50 gal: EF = 0.58	 Gallons = EF = Gallons = EF =
Air conditioning systems (see Note 7)	SEER = 13.0	SEER =
Heat pump systems	SEER = HSPF =	SEER = HSPF =
Natural gas furnaces	AFUE = 78%	AFUE =
Oil furnaces	AFUE = 78%	AFUE =
Ductwork:	Unconditioned: R-6 Conditioned: R-4.2	Location: R-Value =
Air Handler location:	Garage, Attic or Interior	Location:

(1) Each component present in the As-Built home must meet or exceed each of the applicable performance criteria in order to comply with this code using this method; otherwise Method A compliance must be used.

(2) Windows and doors qualifying as glazed fenestration areas must comply with both the maximum U-Facttor and the maximum SHGC (Solar Heat Gain Coefficient) criteria and have a maximum total window area equal to or less than 16% of the conditioned floor area (CFA), otherwise Method A must be used for compliance.

(3) R-Values are for insulation material only as applied in accordance manufacturers' installation instructions. For mass walls, the interior (Int) requirement must be met unless at least 50% of the insulation value is on the exterior (Ext) or integral to the wall.

(4) Attic knee walls shall be insulated to same level as ceilings and shall have a positive means of maintaining insulation in place. Such means may include rigid insulation board or air barrier sheet materials adequately fastened to the attic sides of knee wall framing materials.

(5) For other electric storage volumes, minimum EF = 0.97 - (0.00132*volume)

(6) For other natural gas storage volumes, minimum EF = 0.67 - (0.0019*volume)

(7) For all conventional units with capacities greater than 30,000 Btu/hr. For Small-Duct, High-Velocity units, Space Constrained units, and units with capacities less than 30,000 Btu/hr see Table 13-607.ABC.3.2A of the Florida Building Code, Building, or Table N1107.ABC.3.2A of the Florida Building Code, Residential.

(8) For all conventional units with capacities greater than 30,000 Btu/hr. For Small-Duct, High-Velocity units, Space Constrained units, and units with capacities less than 30,000 Btu/hr see Table 13-607.ABC.3.2B of the Florida Building Code, Building, or Table N1107.ABC.3.2B of the Florida Building Code, Residential.

TABLE 11B-2 MINIMUM REQUIREMENTS FOR ALL PACKAGES

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Exterior Joints & Cracks	N1106.ABC.1.2	To be caulked, gasketed, weather-stripped or otherwise sealed.	
Exterior Windows & Doors	N1106.ABC.1.1	Max .3 cfm/sq.ft. window area; .5 cfm/sq.ft. door area.	
Sole & Top Plates	N1106.ABC.1.2.1	Sole plates and penetrations through top plates of exterior walls must be sealed.	
Recessed Lighting	N1106.ABC.1.2.4	Type IC rated with no penetrations (two alternatives allowed).	
Multistory Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Exhaust Fans	N1106.ABC.1.3	Exhaust fans vented to unconditioned space shall have dampers, except for combustion devices with integral exhaust ductwork.	
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker electric or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have minimum thermal efficiency of 78%.	
Hot Water Pipes	N1112.ABC.5	Insulation is required for hot water circulating systems (including heat recovery units).	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
HVAC Duct Construction, Insulation & Installation	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated and installed in accordance with the criteria of Section N1110.ABC. Ducts in attics must be insulated to a minimum of R-6.	
HVAC Controls	N1107.ABC.2	Separate readily accessible manual or automatic thermostat for each system.	

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 1100B-07 — **Residential Component Prescriptive Method B** — **CENTRAL 4 5 6**

Compliance with Method B Chapter 11 of the Florida Building Code, Residential may be demonstrated by the use of Form 1100B for single- and multiple-family residences of three stories or less in height, and additions to existing residential buildings. To comply, a building must meet or exceed all of the energy efficiency prescriptives in any one of the prescriptive component packages and comply with the prescriptives listed in this form. An alternative method is provided for additions of 600 square feet or less by use of Form 1100C. If a building does not comply with this method, it may still comply under other sections in Chapter 11 of the code.

PROJECT NAME: AND ADDRESS:	**BUILDER:**	
	PERMITTING OFFICE:	**CLIMATE ZONE:** 4 ☐ 5 ☐ 6 ☐
OWNER:	**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

1. New construction including additions which incorporate any of the following features cannot comply using this method: steel stud walls, single assembly roof/ceiling construction, or skylights or other nonvertical roof glass.
2. Choose one of the component packages "A" through "C" from Table 11B-1 by which you intend to comply with the code. Circle the column of the package you have choosen.
3. Fill in all the applicable spaces of the "To Be Installed" column on "Table 11B-1 with the information requested. All "To Be Installed" values must be equal to or more efficient than the required levels.
4. Complete page 1 based on the "To Be Installed" column information.
5. Read "Minimum Requirements for All Packages", Table 11B-2 and check each box to indicate your intent to comply with all applicable items.
6. Read, sign and date the "Prepared By" certification statement at the bottom of page 1. The owner or owner's agent must also sign and date the form.

	Please Print	CK
1. New construction or addition	1. _____	____
2. Single-family detached or multiple-family attached	2. _____	____
3. If multiple-family–No. of units covered by this submission	3. _____	____
4. Is this a worst case? (yes/no)	4. _____	____
5. Conditioned floor area (sq. ft.)	5. _____	____
		____
6. Glass type and area:	6a. _____	____
a. U-factor (or DEFAULT)	6b. _____	
b. SHGC (or DEFAULT)	6c. _____sq. ft.	____
c. Glass area		____
7. Percentage of glass to floor area	7. _____ %	____
8. Floor type, area or perimeter, and insulation:	8a R =_____ _____ lin. ft.	
a. Slab-on-grade (*R*-value)	8b. R =_____ _____ sq. ft.	____
b. Wood, raised (*R*-value)	8c. R =_____ _____ sq. ft.	____
c. Wood, common (*R*-value)	8d. R =_____ _____ sq. ft	____
d. Concrete, raised (*R*-value)	8e. R =_____ _____ sq. ft.	____
e. Concrete, common (*R*-value)		____
9. Wall type, area and insulation:		
a. Exterior: 1. Masonry (Insulation *R*-value)	9a-1 R =_____ _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9a-2 R =_____ _____ sq. ft.	____
		____
b. Adjacent: 1. Masonry (Insulation *R*-value)	9b-1 R =_____ _____ sq. ft.	____
2. Wood frame (Insulation *R*-value)	9b-2 R =_____ _____ sq. ft.	____
10. Ceiling type, area and insulation:		____
a. Under attic (Insulation *R*-value)	10a. R =_____ sq. ft.____	
b. Single assembly (Insulation *R*-value)	10b. R =_____ _____ sq. ft.	
11. Air distribution system: Duct insulation, location	11. R =_____ _____	____
Test report (attach if required)		____
12. Cooling system:	12a. Type: _____	____
(Types: central, room unit, package terminal A.C., gas, none)	12b. SEER/EER: _____	
	12c. Capacity: _____	____
13. Heating system:	13a. Type: _____	____
(Types: heat pump, elec. strip, nat. gas, LP-Gas, gas h.p., room or PTAC, none)	13b. HSPF/COP/AFUE: _____	____
	13c. Capacity: _____	____
14. Hot water system:	14a. Type: _____	____
(Types: elec., nat. gas, LP-gas, solar, heat rec., ded. heat pump, other, none)	14b. EF: _____	____
		____

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

DATE: _____

TABLE 11B-1 **MINIMUM REQUIREMENTS** **Climate Zones 4 5 6**

BUILDING COMPONENT	PERFORMANCE CRITERIA	INSTALLED VALUES:
Windows (see Note 2):	U-Factor = 0.75 SHGC = 0.40 % of CFA < = 16%	U-Factor = SHGC = % of CFA =
Exterior door type	Wood or insulated	Type:
Walls – Ext. and Adj. (see Note 3): Frame Mass Interior: Exterior:	 R-13 R-6 R-4	 R-Value = R-Value = R-Value =
Ceilings (see Notes 3 & 4)	R=30	R-Value =
Floors: Slab-on-grade Over unconditioned spaces (see Note 3)	No requirement R-13	R-Value =
Hot water systems (storage type) Electric (see Note 5): Natural gas (see Note 6):	 40 gal: EF = 0.92 50 gal: EF = 0.90 40 gal: EF = 0.59 50 gal: EF = 0.58	 Gallons = EF = Gallons = EF =
Air conditioning systems (see Note 7)	SEER = 13.0	SEER =
Heat pump systems	SEER = HSPF =	SEER = HSPF =
Natural gas furnaces	AFUE = 78%	AFUE =
Oil furnaces	AFUE = 78%	AFUE =
Ductwork:	Unconditioned: R-6 Conditioned: R-4.2	Location: R-Value =
Air Handler location:	Garage, Attic or Interior	Location:

(1) Each component present in the As-Built home must meet or exceed each of the applicable performance criteria in order to comply with this code using this method; otherwise Method A compliance must be used.

(2) Windows and doors qualifying as glazed fenestration areas must comply with both the maximum U-Facttor and the maximum SHGC (Solar Heat Gain Coefficient) criteria and have a maximum total window area equal to or less than 16% of the conditioned floor area (CFA), otherwise Method A must be used for compliance.

(3) R-Values are for insulation material only as applied in accordance manufacturers' installation instructions. For mass walls, the interior (Int) requirement must be met unless at least 50% of the insulation value is on the exterior (Ext) or integral to the wall.

(4) Attic knee walls shall be insulated to same level as ceilings and shall have a positive means of maintaining insulation in place. Such means may include rigid insulation board or air barrier sheet materials adequately fastened to the attic sides of knee wall framing materials.

(5) For other electric storage volumes, minimum EF = 0.97 - (0.00132*volume)

(6) For other natural gas storage volumes, minimum EF = 0.67 - (0.0019*volume)

(7) For all conventional units with capacities greater than 30,000 Btu/hr. For Small-Duct, High-Velocity units, Space Constrained units, and units with capacities less than 30,000 Btu/hr see Table 13-607.ABC.3.2A of the Florida Building Code, Building, or Table N1107.ABC.3.2A of the Florida Building Code, Residential.

(8) For all conventional units with capacities greater than 30,000 Btu/hr. For Small-Duct, High-Velocity units, Space Constrained units, and units with capacities less than 30,000 Btu/hr see Table 13-607.ABC.3.2B of the Florida Building Code, Building, or Table N1107.ABC.3.2B of the Florida Building Code, Residential.

TABLE 11B-2 MINIMUM REQUIREMENTS FOR ALL PACKAGES

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Exterior Joints & Cracks	N1106.ABC.1.2	To be caulked, gasketed, weather-stripped or otherwise sealed.	
Exterior Windows & Doors	N1106.ABC.1.1	Max .3 cfm/sq.ft. window area; .5 cfm/sq.ft. door area.	
Sole & Top Plates	N1106.ABC.1.2.1	Sole plates and penetrations through top plates of exterior walls must be sealed.	
Recessed Lighting	N1106.ABC.1.2.4	Type IC rated with no penetrations (two alternatives allowed).	
Multistory Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Exhaust Fans	N1106.ABC.1.3	Exhaust fans vented to unconditioned space shall have dampers, except for combustion devices with integral exhaust ductwork.	
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker electric or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have minimum thermal efficiency of 78%.	
Hot Water Pipes	N1112.ABC.5	Insulation is required for hot water circulating systems (including heat recovery units).	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
HVAC Duct Construction, Insulation & Installation	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated and installed in accordance with the criteria of Section N1110.ABC. Ducts in attics must be insulated to a minimum of R-6.	
HVAC Controls	N1107.ABC.2	Separate readily accessible manual or automatic thermostat for each system.	

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 1100B-07 — **Residential Component Prescriptive Method B** — **SOUTH 7 8 9**

Compliance with Method B of Chapter 11 of the Florida Building Code, Residential may be demonstrated by the use of Form 1100B for single- and multiple-family residences of three stories or less in height, and additions to existing residential buildings. To comply, a building must meet or exceed all of the energy efficiency prescriptives in any one of the prescriptive component packages and comply with the prescriptives listed in this form. An alternative method is provided for additions of 600 square feet or less by use of Form 1100C. If a building does not comply with this method, it may still comply under other sections in Chapter 11 of the code.

PROJECT NAME: AND ADDRESS:	**BUILDER:**	
	PERMITTING OFFICE:	**CLIMATE ZONE:** 7 ☐ 8 ☐ 9 ☐
OWNER:	**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

1. New construction including additions which incorporate any of the following features cannot comply using this method: steel stud walls, single assembly roof/ceiling construction, or skylights or other nonvertical roof glass.
2. *Choose one of the component packages* "A" through "C" from Table 11B-1 by which you intend to comply with the code. Circle the column of the package you have choosen.
3. Fill in all the applicable spaces of the "To Be Installed" column on+ "Table 11B-1 with the information requested. All "To Be Installed" values must be equal to or more efficient than the required levels.
4. Complete page 1 based on the "To Be Installed" column information.
5. Read "Minimum Requirements for All Packages", Table 11B-2 and check each box to indicate your intent to comply with all applicable items.
6. Read, sign and date the "Prepared By" certification statement at the bottom of page 1. The owner or owner's agent must also sign and date the form.

	Please Type	CK
1. New construction or addition	1. _____	____
2. Single-family detached or multiple-family attached	2. _____	____
3. If multiple-family–No. of units covered by this submission	3. _____	____
4. Is this a worst case? (yes/no)	4. _____	____
5. Conditioned floor area (sq. ft.)	5. _____	____
		____
6. Glass type and area:		
a. U-factor (or DEFAULT)	6a. _____	____
b. SHGC (or DEFAULT)	6b. _____	
c. Glass area	6c. _____sq. ft.	____
		____
7. Percentage of glass to floor area	7. _____ %	____
8. Floor type, area or perimeter, and insulation:		
a. Slab-on-grade (***R***-value)	8a R =_____ _____ lin. ft.	____
b. Wood, raised (***R***-value)	8b. R =_____ _____ sq. ft.	____
c. Wood, common (***R***-value)	8c. R =_____ _____ sq. ft.	____
d. Concrete, raised (***R***-value)	8d. R =_____ _____ sq. ft.	____
e. Concrete, common (***R***-value)	8e. R =_____ _____ sq. Ft.	
9. Wall type, area and insulation:		____
a. Exterior: 1. Masonry (Insulation ***R***-value)	9a-1 R =_____ _____ sq. ft.	____
2. Wood frame (Insulation ***R***-value)	9a-2 R =_____ _____ sq. ft.	____
b. Adjacent: 1. Masonry (Insulation ***R***-value)	9b-1 R =_____ _____ sq. ft.	
2. Wood frame (Insulation ***R***-value)	9b-2 R =_____ _____ sq. ft.	____
		____
10. Ceiling type, area and insulation:		
a. Under attic (Insulation ***R***-value)	10a. R =_____ sq. ft._____	____
b. Single assembly (Insulation ***R***-value)	10b. R =_____ _____ sq. ft.	____
		____
11. Air distribution system: Duct insulation, location	11. R =_____ _____	____
Test report (attach if required)		____
		____
12. Cooling system:	12a. Type: _____	____
(Types: central, room unit, package terminal A.C., gas, none)	12b. SEER/EER: _____	____
	12c. Capacity: _____	____
13. Heating system:	13a. Type: _____	____
(Types: heat pump, elec. strip, nat. gas, LP-Gas, gas h.p., room or PTAC, none)	13b. HSPF/COP/AFUE: _____	____
	13c. Capacity: _____	____
14. Hot water system:	14a. Type: _____	____
(Types: elec., nat. gas, LP-gas, solar, heat rec., ded. heat pump, other, none)	14b. EF: _____	____

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

DATE: _____

TABLE 11B-1 **MINIMUM REQUIREMENTS** **Climate Zones 7 8 9**

BUILDING COMPONENT	PERFORMANCE CRITERIA	INSTALLED VALUES:
Windows (see Note 2):	U-Factor = 0.75 SHGC = 0.40 % of CFA < = 16%	U-Factor = SHGC = % of CFA =
Exterior door type	Wood or insulated	Type:
Walls Frame Mass Interior: Exterior:	 R-13 R-4 R-3	 R-Value = R-Value = R-Value =
Ceilings (see Notes 3 & 4)	R=30	R-Value =
Floors: Slab-on-grade Over unconditioned spaces (see Note 3)	No requirement R-13	R-Value =
Hot water systems (storage type) Electric (see Note 5): Natural gas (see Note 6):	 40 gal: EF = 0.92 50 gal: EF = 0.90 40 gal: EF = 0.59 50 gal: EF = 0.58	 Gallons = EF = Gallons = EF =
Air conditioning systems (see Note 7)	SEER = 13.0	SEER =
Heat pump systems	SEER = HSPF =	SEER = HSPF =
Natural gas furnaces	AFUE = 78%	AFUE =
Oil furnaces	AFUE = 78%	AFUE =
Ductwork:	Unconditioned: R-6 Conditioned: R-4.2	Location: R-Value =
Air Handler location:	Garage, Attic or Interior	Location:

(1) Each component present in the As-Built home must meet or exceed each of the applicable performance criteria in order to comply with this code using this method; otherwise Method A compliance must be used.

(2) Windows and doors qualifying as glazed fenestration areas must comply with both the maximum U-Facttor and the maximum SHGC (Solar Heat Gain Coefficient) criteria and have a maximum total window area equal to or less than 16% of the conditioned floor area (CFA), otherwise Method A must be used for compliance.

(3) R-Values are for insulation material only as applied in accordance manufacturers' installation instructions. For mass walls, the interior (Int) requirement must be met unless at least 50% of the insulation value is on the exterior (Ext) or integral to the wall.

(4) Attic knee walls shall be insulated to same level as ceilings and shall have a positive means of maintaining insulation in place. Such means may include rigid insulation board or air barrier sheet materials adequately fastened to the attic sides of knee wall framing materials.

(5) For other electric storage volumes, minimum EF = 0.97 - (0.00132*volume)

(6) For other natural gas storage volumes, minimum EF = 0.67 - (0.0019*volume)

(7) For all conventional units with capacities greater than 30,000 Btu/hr. For Small-Duct, High-Velocity units, Space Constrained units, and units with capacities less than 30,000 Btu/hr see Table 13-607.ABC.3.2A of the Florida Building Code, Building, or Table N1107.ABC.3.2A of the Florida Building Code, Residential.

(8) For all conventional units with capacities greater than 30,000 Btu/hr. For Small-Duct, High-Velocity units, Space Constrained units, and units with capacities less than 30,000 Btu/hr see Table 13-607.ABC.3.2B of the Florida Building Code, Building, or Table N1107.ABC.3.2B of the Florida Building Code, Residential.

TABLE 11B-2 MINIMUM REQUIREMENTS FOR ALL PACKAGES

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Exterior Joints & Cracks	N1106.ABC.1.2	To be caulked, gasketed, weather-stripped or otherwise sealed.	
Exterior Windows & Doors	N1106.ABC.1.1	Max .3 cfm/sq.ft. window area; .5 cfm/sq.ft. door area.	
Sole & Top Plates	N1106.ABC.1.2.1	Sole plates and penetrations through top plates of exterior walls must be sealed.	
Recessed Lighting	N1106.ABC.1.2.4	Type IC rated with no penetrations (two alternatives allowed).	
Multistory Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Exhaust Fans	N1106.ABC.1.3	Exhaust fans vented to unconditioned space shall have dampers, except for combustion devices with integral exhaust ductwork.	
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker electric or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have minimum thermal efficiency of 78%.	
Hot Water Pipes	N1112.ABC.5	Insulation is required for hot water circulating systems (including heat recovery units).	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
HVAC Duct Construction, Insulation & Installation	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated and installed in accordance with the criteria of Section N1110.ABC. Ducts in attics must be insulated to a minimum of R-6.	
HVAC Controls	N1107.ABC.2	Separate readily accessible manual or automatic thermostat for each system.	

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 1100C-07 — **Residential Limited Applications Prescriptive Method C** — **NORTH 1 2 3**

Small Additions, Renovations & Building Systems

+Compliance with Method C of Chapter 11 of the Florida Building Code, Residential, may be demonstrated by the use of Form 1100C-07 for additions of 600 square feet or less, site-installed components of manufactured homes, and renovations to single- and multiple-family residences. Alternative methods are provided for additions by use of Form 1100B-07 or 1100A-07.

PROJECT NAME: AND ADDRESS:	**BUILDER:**	
	PERMITTING OFFICE:	**CLIMATE ZONE:** 1 ☐ 2 ☐ 3 ☐
OWNER:	**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

SMALL ADDITIONS TO EXISTING RESIDENCES (600 square feet or less of conditioned area). Prescriptive requirements in Tables 11C-1, 11C-2, and 11C-3 apply only to the components of the addition, not to the existing building. Space heating, cooling, and water heating equipment efficiency levels must be met only when equipment is installed specifically to serve the addition or is being installed in conjunction with the addition construction. Components separating unconditioned spaces from conditioned spaces must meet the prescribed minimum insulation levels. RENOVATIONS (Residential buildings undergoing renovations costing more than 30% of the assessed value of the building). Prescriptive requirements in Tables 11C-1 and 11C-2 apply only to the components and equipment being renovated or replaced. MANUFACTURED HOMES AND BUILDINGS. Only site-installed components and features are covered by this form. BUILDING SYSTEMS. Comply when complete new system is installed.

	Please Print	CK
1. Renovation, Addition, New System or Manufactured Home	1. _____	
2. Single-family detached or Multiple-family attached	2. _____	
3. If Multiple-family–No. of units covered by this submission	3. _____	
4. Conditioned floor area (sq. ft.)	4. _____	
5. Predominant eave overhang (ft.)	5. _____	
6. Glass type and area:	Single Pane / Double Pane	
a. Clear glass	6a. _____ sq. ft. / _____ sq. ft.	
b. Tint, film or solar screen	6b. _____ sq. ft. / _____ sq. ft.	
7. Percentage of glass to floor area	7. _____ %	
8. Floor type and insulation:		
a. Slab-on-grade (R-value)	8a R=_____ _____ lin. ft.	
b. Wood, raised (R-value)	8b. R=_____ _____ sq. ft.	
c. Wood, common (R-value)	8c. R=_____ _____ sq. ft.	
d. Concrete, raised (R-value)	8d. R=_____ _____ sq. ft.	
e. Concrete, common (R-value)	8e. R=_____ _____ sq. ft.	
9. Wall type and insulation:		
a. Exterior: 1. Masonry (Insulation R-value)	9a-1 R=_____ _____ sq. ft.	
2. Wood frame (Insulation R-value)	9a-2 R=_____ _____ sq. ft.	
b. Adjacent: 1. Masonry (Insulation R-value)	9b-1 R=_____ _____ sq. ft.	
2. Wood frame (Insulation R-value)	9b-2 R=_____ _____ sq. ft.	
c. Marriage Walls of Multiple Units* (Yes/No)	9c _____ _____	
10. Ceiling type and insulation:		
a. Under attic (Insulation R-value)	10a. R=_____ _____ sq. ft.	
b. Single assembly (Insulation R-value)	10b. R=_____ _____ sq. ft.	
11. Cooling system*	11. Type: _____	
(Types: central, room unit, package terminal A.C., gas, existing, none)	SEER/EER: _____	
12. Heating system*	12. Type: _____	
(Types: heat pump, elec. strip, natural gas, LP-gas, gas h.p., room or PTAC, existing, none)	HSPF/COP/AFUE:_____	
13. Air distribution system*	13a. _____	
a. Backflow damper or single package systems* (Yes/No)	13b. _____	
b. Ducts on marriage walls adequately sealed* (Yes/No)	14. Type: _____	
14. Hot water system:	EF: _____	
(Types: elec., natural gas, other, existing, none)		

* Pertains to manufactured homes with site-installed components.

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

DATE: _____

Climate Zones 1, 2, 3

TABLE 11C-1: PRESCRIPTIVE REQUIREMENTS FOR SMALL ADDITIONS (600 Sq. Ft. and Less), RENOVATIONS TO EXISTING BUILDINGS AND SITE-INSTALLED COMPONENTS OF MANUFACTURED HOMES

	COMPONENT	MINIMUM INSULATION	INSULATION INSTALLED
WALLS	Concrete Block	R-7	_____
	Frame, 2' x 4'	R-11	_____
	Frame, 2' x 6'	R-19	_____
	Common, Frame	R-11	_____
	Common, Masonry	R-3	_____
CEILINGS	Under Attic	R-30	_____
	Single Assembly; Enclosed		_____
	Frame	R-19	_____
	Metal Pans	R-13	_____
	Single Assembly; Open	R-10	_____
	Common, Frame	R-11	_____
FLOORS	Slab-on-grade	No Minimum	_____
	Raised Wood	R-19	_____
	Raised Concrete	R-7	_____
	Common, Frame	R-11	_____
DUCT	In unconditioned space	R-6	_____
	In conditioned space	No minimum	_____

	EQUIPMENT	MINIMUM EFFICIENCY	INSTALLED EFFICIENCY
COOLING	Central A/C - Split	SEER = 13.0*	SEER = _____
	- Single Pkg.	SEER = 13.0*	SEER = _____
	Room unit or PTAC	EER = 8.5*	EER = _____
SPACE HEATING	Electric Resistance	ANY	
	Heat pump - Split	HSPF = 7.7*	HSPF = _____
	- Single Pkg.	HSPF = 7.7*	HSPF = _____
	Room unit or PTHP	COP = 2.7*	HSPF/COP = _____
	Gas, natural or propane	AFUE = .78	AFUE = _____
	Fuel Oil	AFUE = .78	AFUE = _____
HOT WATER	Electric Resistance	EF = .92	EF = _____
	Gas; natural or LP	EF = .59	EF = _____
	Fuel Oil	EF = .54	EF = _____

* See Table 1107.ABC.3.2 and 1108.1.ABC.3.2

TABLE 11C-2: PRESCRIPTIVE REQUIREMENTS FOR GLASS AREAS IN ADDITIONS ONLY

Maximum percentage glass to floor area allowed is selected by type, overhang length, and solar heat gain coefficient. Maximum % = ____ Installed % = ____

GLASS TYPE, OVERHANG, AND SOLAR HEAT GAIN COEFFICIENT REQUIRED FOR GLASS PERCENTAGE ALLOWED

UP TO 20%		UP TO 30%		UP TO 40%		UP TO 50%	
Single	Double	Single	Double	Single	Double	Single	Double
OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC
1' - .87 0' - .75	0' - .78	2' - .87 1' - .75 0' - .57	1' - .78 0' - .61	NOT ALLOWED	2' - .78 1' - .61 0' - .44	NOT ALLOWED	3' - .78 2' - .61 1' - .44 0' - .35

Get certified SHGC from the manufacturer or use defaults: Single clear SHGC = .75, double clear SHGC = .66, and single tint SHGC = .64

TABLE 11C-3 MINIMUM REQUIREMENTS FOR ALL PACKAGES

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Exterior Joints & Cracks	N1106.ABC.1.2	To be caulked, gasketed, weather-stripped or otherwise sealed.	
Exterior Windows & Doors	N1106.ABC.1.1	Max. 0.3 cfm/sq.ft. window area; .5 cfm/sq.ft. door area.	
Sole & Top Plates	N1106.ABC.1.2.1	Sole plates and penetrations through top plates of exterior walls must be sealed.	
Recessed Lighting	N1106.ABC.1.2.4	Type IC rated with no penetrations (two alternatives allowed).	
Multiple Story Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Exhaust Fans	N1106.ABC.1.3	Exhaust fans vented to unconditioned space shall have dampers, except for combustion devices with integral exhaust ductwork.	
Combustion Heating	N1106.ABC.1.3	Combustion space and water heating systems must be provided with outside combustion air, except for direct vent appliances.	
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker electric or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have minimum thermal efficiency of 78%.	
Hot Water Pipes	N1112.ABC.5	Insulation is required for hot water circulating systems (including heat recovery units).	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
HVAC Duct Construction, Insulation & Installation	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated and installed in accordance with the criteria of Section N1110.ABC. Ducts in attics must be insulated to a minimum of R-6.	
HVAC Controls	N1107.ABC.2	Separate readily accessible manual or automatic thermostat for each system.	

GENERAL DIRECTIONS:

1. On Table 11C-1 indicate the R-value of the insulation being added to each component and the efficiency levels of the equipment being installed. All R-values and efficiencies installed must meet or exceed the minimum values listed. Components and equipment neither being added nor renovated may be left blank.
2. ADDITIONS ONLY. Determine the percentage of new glass to conditioned floor area in the addition as follows. Total the areas of all glass windows, sliding glass doors and glass door panels. Double the area of all nonvertical roof glass and add it to the previous total. When glass in existing exterior walls is being removed or enclosed by the addition, an amount equal to the total area of this glass may be subtracted from the total glass area. Divide the adjusted glass area total by the conditioned floor area of the addition. Multiply by 100 to get the percent. Find the largest glass percentage under which your calculated percentage falls on Table 11C-2. Prescriptives are given by the type of glass (single or double pane) and the overhang (OH) paired with a solar heat gain coefficient (SHGC). For a given glass type and overhang, the minimum solar heat gain coefficient allowed is specified. Actual glass windows and doors previously in the exterior walls of the house and being reinstalled in the addition do not have to comply with the overhang and solar heat gain coefficient requirements on Table 11C-2. All new glass in the addition must meet the requirement for one of the options in the glass percentage category you indicated. The overhang (OH) distance is measured perpendicularly from the face of the glass to a point directly under the outermost edge of the overhang.
3. RENOVATIONS ONLY. Replacement glass needs to meet the following requirements. Any glass type and solar heat gain coefficient may be used for glass areas which are under at least a 2-foot overhang and whose lowest edge does not extend further than 8 feet from the overhang. Glass areas being renovated that do not meet this criteria must be either single-pane tinted, double-pane clear or double-pane tinted.
4. BUILDING SYSTEMS. Comply when new system is installed for system installed.
5. Complete the information requested on the top half of page 1.
6. Read "Minimum Requirements for Small Additions and Renovations," Table 11C-3, and check all applicable items.
7. Read, sign and date the "Owner/Agent" certification statement on page 1.

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 1100C-07 **Residential Limited Applications Prescriptive Method C** **CENTRAL 4 5 6**

Small Additions, Renovations & Building Systems

Compliance with Method C of Chapter 11 of the Florida Building Code, Residential may be demonstrated by the use of Form 1100C-07 for additions of 600 square feet or less, site-installed components of manufactured homes, and renovations to single- and multiple-family residences. Alternative methods are provided for additions by use of Form 1100B-07 or 1100A-07.

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 4 ☐ 5 ☐ 6 ☐
OWNER:		**PERMIT NO.:**	**JURISDICTION NO.:**

SMALL ADDITIONS TO EXISTING RESIDENCES (600 square feet or less of conditioned area). Prescriptive requirements in Tables 11C-1, 11C-2, and 11C-3 apply only to the components of the addition, not to the existing building. Space heating, cooling, and water heating equipment efficiency levels must be met only when equipment is installed specifically to serve the addition or is being installed in conjunction with the addition construction. Components separating unconditioned spaces from conditioned spaces must meet the prescribed minimum insulation levels. RENOVATIONS (Residential buildings undergoing renovations costing more than 30% of the assessed value of the building). Prescriptive requirements in Tables 11C-1 and 11C-2 apply only to the components and equipment being renovated or replaced. MANUFACTURED HOMES AND BUILDINGS. Only site-installed components and features are covered by this form. BUILDING SYSTEMS. Comply when complete new system is installed.

	Please Print	CK
1. Renovation, Addition, New System or Manufactured Home	1. _____	____
2. Single-family detached or Multiple-family attached	2. _____	____
3. If Multiple-family–No. of units covered by this submission	3. _____	____
4. Conditioned floor area (sq. ft.)	4. _____	____
5. Predominant eave overhang (ft.)	5. _____	____
6. Glass type and area:	Single Pane Double Pane	
a. Clear glass	**6a.** _____ **sq. ft.** _____ **sq. ft.**	____
b. Tint, film or solar screen	**6b.** _____ **sq. ft.** _____ **sq. ft.**	____
7. Percentage of glass to floor area	**7.** _____%	____
8. Floor type and insulation:		
a. Slab-on-grade (R-value)	**8a** R = _____ _____ lin. ft.	____
b. Wood, raised (R-value)	**8b.** R =_____ _____ sq. ft.	____
c. Wood, common (R-value)	**8c.** R =_____ _____ sq. ft.	____
d. Concrete, raised (R-value)	**8d.** R =_____ _____ sq. ft.	____
e. Concrete, common (R-value)	**8e.** R =_____ _____ sq. ft.	____
9. Wall type and insulation:		
a. Exterior: 1. Masonry (Insulation R-value)	**9a-1** R =_____ _____ sq. ft.	____
2. Wood frame (Insulation R-value)	**9a-2** R =_____ _____ sq. ft.	____
b. Adjacent: 1. Masonry (Insulation R-value)	**9b-1** R =_____ _____ sq. ft.	____
2. Wood frame (Insulation R-value)	**9b-2** R =_____ _____ sq. ft.	____
	9c. _____ _____	____
c. Marriage Walls of Multiple Units* (Yes/No)	**10a.** R =_____ _____ sq. ft.	____
10. Ceiling type and insulation:	**10b.** R =_____ _____ sq. ft.	____
a. Under attic (Insulation R-value)		
b. Single assembly (Insulation R-value)	**11. Type:** _____	____
11. Cooling system*	**SEER/EER:** _____	
(Types: central, room unit, package terminal A.C., gas, existing, none)	**12. Type:** _____	____
12. Heating system*	**HSPF/COP/AFUE:**_____	____
(Types: heat pump, elec. strip, natural gas, LP-gas, gas h.p., room or PTAC, existing, none)		
13. Air distribution system*	**13a.** _____	____
a. Backflow damper or single package systems* (Yes/No)	**13b.** _____	____
b. Ducts on marriage walls adequately sealed* (Yes/No)	**14. Type:** _____	____
14. Hot water system:	**EF:** _____	____

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

DATE: _____

Climate Zones 4, 5, 6

TABLE 11C-1: PRESCRIPTIVE REQUIREMENTS FOR SMALL ADDITIONS (600 Sq. Ft. and Less), RENOVATIONS TO EXISTNG BUILDINGS AND SITE-INSTALLED COMPONENTS OF MANUFACTURED

	COMPONENT	MINIMUM INSULATION	INSULATION INSTALLED
WALLS	Concrete Block	R-5	_____
	Frame, 2' x 4'	R-11	_____
	Frame, 2' x 4'	R-19	_____
	Common, Frame	R-11	_____
	Common, Masonry	R-3	_____
CEILINGS	Under Attic	R-30	_____
	Single Assembly; Enclosed		_____
	Frame	R-19	_____
	Metal Pans	R-13	_____
	Single Assembly; Open	R-10	_____
	Common, Frame	R-11	_____
FLOORS	Slab-on-grade	No Minimum	_____
	Raised Wood	R-11	_____
	Raised Concrete	R-5	_____
	Common, Frame	R-11	_____
DUCT	In unconditioned space	R-6	_____
	In conditioned space	No minimum	_____

	EQUIPMENT	MINIMUM EFFICIENCY	INSTALLED EFFICIENCY
COOLING	Central A/C - Split	SEER = 13.0*	SEER = _____
	- Single Pkg.	SEER = 13.0*	SEER = _____
	Room unit or PTAC	EER = 8.5*	EER = _____
SPACE HEATING	Electric Resistance	ANY	
	Heat pump - Split	HSPF = 7.7*	HSPF = _____
	- Single Pkg.	HSPF = 7.7*	HSPF = _____
	Room unit or PTHP	COP = 2.7*	HSPF/COP = _____
	Gas, natural or propane	AFUE = .78	AFUE = _____
	Fuel Oil	AFUE = .78	AFUE = _____
HOT WATER	Electric Resistance	EF = .92	EF = _____
	Gas; natural or LP-gas	EF = .59	EF = _____
	Fuel Oil	EF = .54	EF = _____

* See Table 1107.ABC.3.2 and 1108.ABC.3.2

HOMES

Maximum percentage glass to floor area allowed is selected by type, overhang length, and solar heat gain coefficient. Maximum % = ____ Installed % = _____

GLASS TYPE, OVERHANG, AND SOLAR HEAT GAIN COEFFICIENT REQUIRED FOR GLASS PERCENTAGE ALLOWED

UP TO 20%		UP TO 30%		UP TO 40%		UP TO 50%	
Single	Double	Single	Double	Single	Double	Single	Double
OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC
1' - .87	0' - .78	2' - .87	1' - .78	3' - .87	2' - .78	4' - .87	3' - .78
0' - .75		1' - .75	0' - .61	2' - .75	1' - .61	3' - .75	2' - .61
		0' - .57		1' - .57	0' - .44	2' - .57	1' - .44
				0' - .39		1' - .39	0' - .35
						0' - .30	

Get certified SHGC from the manufacturer or use defaults: Single clear SHGC = .75, double clear SHGC = .66, and single tint SHGC = .64

TABLE 11C-3 MINIMUM REQUIREMENTS FOR ALL PACKAGES

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Exterior Joints & Cracks	N1106.ABC.1.2	To be caulked, gasketed, weather-stripped or otherwise sealed.	
Exterior Windows & Doors	N1106.ABC.1.1	Max. 0.3 cfm/sq.ft. window area; .5 cfm/sq.ft. door area.	
Sole & Top Plates	N1106.ABC.1.2.1	Sole plates and penetrations through top plates of exterior walls must be sealed.	
Recessed Lighting	N1106.ABC.1.2.4	Type IC rated with no penetrations (two alternatives allowed).	
Multiple Story Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Exhaust Fans	N1106.ABC.1.3	Exhaust fans vented to unconditioned space shall have dampers, except for combustion devices with integral exhaust ductwork.	
Combustion Heating	N1106.ABC.1.3	Combustion space and water heating systems must be provided with outside combustion air, except for direct vent appliances.	
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker electric or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have minimum thermal efficiency of 78%.	
Hot Water Pipes	N1112.ABC.5	Insulation is required for hot water circulating systems (including heat recovery units).	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
HVAC Duct Construction, Insulation & Installation	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated and installed in accordance with the criteria of Section N1110.ABC. Ducts in attics must be insulated to a minimum of R-6.	
HVAC Controls	N1107.ABC.2	Separate readily accessible manual or automatic thermostat for each system.	

TABLE 11C-2: PRESCRIPTIVE REQUIREMENTS FOR GLASS AREAS IN ADDITIONS ONLY

GENERAL DIRECTIONS:

1. On Table 11C-1 indicate the R-value of the insulation being added to each component and the efficiency levels of the equipment being installed. All R-values and efficiencies installed must meet or exceed the minimum values listed. Components and equipment neither being added nor renovated may be left blank.

2. ADDITIONS ONLY. Determine the percentage of new glass to conditioned floor area in the addition as follows. Total the areas of all glass windows, sliding glass doors and glass door panels. Double the area of all nonvertical roof glass and add it to the previous total. When glass in existing exterior walls is being removed or enclosed by the addition, an amount equal to the total area of this glass may be subtracted from the total glass area. Divide the adjusted glass area total by the conditioned floor area of the addition. Multiply by 100 to get the percent. Find the largest glass percentage under which your calculated percentage falls on Table 11C-2. Prescriptives are given by the type of glass (single or double pane) and the overhang (OH) paired with a solar heat gain coefficient (SHGC). For a given glass type and overhang, the minimum solar heat gain coefficient allowed is specified. Actual glass windows and doors previously in the exterior walls of the housend being reinstalled in the addition do not have to comply with the overhang and solar heat gain coefficient requirements on Table 11C-2. All new glass in the addition must meet the requirement for one of the options in the glass percentage category you indicated. The overhang (OH) distance is measured perpendicularly from the face of the glass to a point directly under the outermost edge of the overhang.

3. RENOVATIONS ONLY. Replacement glass needs to meet the following requirements. Any glass type and solar heat gain coefficient may be used for glass areas which are under at least a 2-foot overhang and whose lowest edge does not extend further than 8 feet from the overhang. Glass areas being renovated that do not meet this criteria must be either single-pane tinted, double-pane clear or double-pane tinted.

4. BUILDING SYSTEMS. Comply when new system is installed for system installed.

5. Complete the information requested on the top half of page 1.

6 Read "Minimum Requirements for Small Additions and Renovations," Table 11C-3, and check all applicable items.

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 1100C-07 **Residential Limited Applications Prescriptive Method C** **SOUTH 7 8 9**

Small Additions, Renovations & Building Systems

Compliance with Method C of Chapter 11 of the Florida Building Code, Residential may be demonstrated by the use of Form 1100C-07 for additions of 600 square feet or less, site-installed components of manufactured homes, and renovations to single- and multiple-family residences. Alternative methods are provided for additions by use of Form 1100B-07 or 1100A-07.

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 7 ☐ 8 ☐ 9 ☐
OWNER:		**PERMIT NO.:**	**JURISDICTION NO.:**

SMALL ADDITIONS TO EXISTING RESIDENCES (600 square feet or less of conditioned area). Prescriptive requirements in Tables 11C-1, 11C-2, and 11C-3 apply only to the components of the addition, not to the existng building. Space heating, cooling, and water heating equipment efficiency levels must be met only when equipment is installed specifically to serve the addition or is being installed in conjunction with the addition construction. Components seperating unconditioned spaces from conditioned spaces must meet the prescribed minimum insulation levels. RENOVATIONS (Residential buildings undergoing renovations costing more than 30% of the assessed value of the building). Prescriptive requirements in Tables 11C-1 and 11C-2 apply only to the components and equipment being renovated or replaced. MANUFACTURED HOMES AND BUILDINGS. Only site-installed components and features are covered by this form. BUILDING SYSTEMS Comply when complete new system is installed.

	Please Print	CK
1. Renovation, Addition, New System or Manufactured Home	1. _____	____
2. Single-family detached or Multiple-family attached	2. _____	____
3. If Multiple-family–No. of units covered by this submission	3. _____	____
4. Conditioned floor area (sq. ft.)	4. _____	____
5. Predominant eave overhang (ft.)	5. _____	____
6. Glass type and area:	Single Pane Double Pane	
a. Clear glass	**6a.** _____ **sq. ft.** _____ **sq. ft.**	____
b. Tint, film or solar screen	**6b.** _____ **sq. ft.** _____ **sq. ft.**	____
7. Percentage of glass to floor area	**7.** _____ **%**	____
8. Floor type and insulation:		
a. Slab-on-grade (R-value)	**8a** **R =**_____ _____ lin. ft.	____
b. Wood, raised (R-value)	**8b.** **R =**_____ _____ sq. ft.	____
c. Wood, common (R-value)	**8c.** **R =**_____ _____ sq. ft.	____
d. Concrete, raised (R-value)	**8d.** **R =**_____ _____ sq. ft.	____
e. Concrete, common (R-value)	**8e.** **R =**_____ _____ sq. ft.	____
9. Wall type and insulation:		
a. *Exterior:* 1. *Masonry (Insulation R-value)*	**9a-1** **R =** _____ _____ sq. ft.	____
2. Wood frame (Insulation R-value)	**9a-2** **R =**_____ _____ sq. ft.	___
b. Adjacent: 1. Masonry (Insulation R-value)	**9b-1** **R =**_____ _____ sq. ft.	____
2. Wood frame (Insulation R-value)	**9b-2** **R =**_____ _____ sq. ft.	____
c. Marriage Walls of Multiple Units* (Yes/No)	**9c.** _____ _____	____
10. Ceiling type and insulation:		
a. Under attic (Insulation R-value)	**10a.** **R =**_____ _____ sq. ft.	____
b. *Single assembly (Insulation R-value)*	**10b.** **R =**_____ _____ sq. ft.	____
11. Cooling system*	**11. Type:** _____	____
(Types: central, room unit, package terminal A.C., gas, existing, none)	**SEER/EER:** _____	____
12. Heating system*	**12. Type:** _____	____
(Types: heat pump, elec. strip, natural gas, LP-gas, gas h.p., room or PTAC, existing, none)	**HSPF/COP/AFUE:**_____	____
13. Air distribution system*	**13a.** _____	____
a. Backflow damper or single package systems* (Yes/No)	**13b.** _____	____
b. Ducts on marriage walls adequately sealed* (Yes/No)	**14. Type:** _____	____
14. Hot water system:	**EF:** _____	____
(Types: elec., natural gas, other, existing, none)		

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

DATE: _____

Climate Zones 7, 8, 9

TABLE 11C-1: PRESCRIPTIVE REQUIREMENTS FOR SMALL ADDITIONS (600 Sq. Ft. and Less), RENOVATIONS TO EXISTNG BUIDLINGS AND SITE-INSTALLED COMPONENTS OF MANUFACTURED HOMES

	COMPONENT	MINIMUM INSULATION	INSULATION INSTALLED
WALLS	Concrete Block	R-5	_____
	Frame, 2' x 4'	R-11	_____
	Frame, 2' x 6'	R-19	_____
	Common, Frame	R-11	_____
	Common, Masonry	R-3	_____
CEILINGS	Under Attic	R-30	_____
	Single Assembly; Enclosed		_____
	Frame	R-19	_____
	Metal Pans	R-13	_____
	Single Assembly; Open	R-10	_____
	Common, Frame	R-11	_____
FLOORS	Slab-on-grade	No Minimum	_____
	Raised Wood	R-11	_____
	Raised Concrete	R-5	_____
	Common, Frame	R-11	_____
DUCT	In unconditioned space	R-6	_____
	In conditioned space	No minimum	_____

	EQUIPMENT	MINIMUM EFFICIENCY	INSTALLED EFFICIENCY
COOLING	Central A/C - Split	SEER = 13.0*	SEER = _____
	- Single Pkg.	SEER = 13.0*	SEER = _____
	Room unit or PTAC	EER = 8.5*	EER = _____
SPACE HEATING	Electric Resistance	ANY	
	Heat pump - Split	HSPF = 7.7*	HSPF = _____
	- Single Pkg.	HSPF = 7.7*	HSPF = _____
	Room unit or PTHP	COP = 2.7*	HSPF/COP = _____
	Gas; natural or propane	AFUE = .78	AFUE = _____
	Fuel Oil	AFUE = .78	AFUE = _____
HOT WATER	Electric Resistance	EF = .92	EF = _____
	Gas; natural or LP	EF = .59	EF = _____
	Fuel Oil	EF = .54	EF = _____

* See Table 1107..ABC.3.2 and 1108.ABC.3.2

TABLE 11C-2: PRESCRIPTIVE REQUIREMENTS FOR GLASS AREAS IN ADDITIONS ONLY

Maximum percentage glass to floor area allowed is selected by type, overhang length, and solar heat gain coefficient. Maximum % = ____ Installed % = ____

GLASS TYPE, OVERHANG, AND SOLAR HEAT GAIN COEFFICIENT REQUIRED FOR GLASS PERCENTAGE ALLOWED

UP TO 20%		UP TO 30%		UP TO 40%		UP TO 50%	
Single	Double	Single	Double	Single	Double	Single	Double
OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC	OH-SHGC
1' - .87	0' - .78	2' - .87	1' - .78	3' - .87	2' - .78	4' - .87	3' - .78
0' - .75		1' - .75	0' - .61	2' - .75	1' - .61	3' - .75	2' - .61
		0' - .57		1' - .57	0' - .44	2' - .57	1' - .44
				0' - .39		1' - .39	0' - .35
						0' - .30	

Get certified SHGC from the manufacturer or use defaults: Single clear SHGC = .75, double clear SHGC = .66, and single tint SHGC = .64

TABLE 11C-3 MINIMUM REQUIREMENTS FOR ALL PACKAGES

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Exterior Joints & Cracks	N1106.ABC.1.2	To be caulked, gasketed, weather-stripped or otherwise sealed.	
Exterior Windows & Doors	N1106.ABC.1.1	Max. 0.3 cfm/sq.ft. window area; .5 cfm/sq.ft. door area.	
Sole & Top Plates	N1106.ABC.1.2.1	Sole plates and penetrations through top plates of exterior walls must be sealed.	
Recessed Lighting	N1106.ABC.1.2.4	Type IC rated with no penetrations (two alternatives allowed).	
Multiple Story Houses	N1106.ABC.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Exhaust Fans	N1106.ABC.1.3	Exhaust fans vented to unconditioned space shall have dampers, except for combustion devices with integral ex - haust ductwork.	
Combustion Heating	N1106.ABC.1.3	Combustion space and water heating systems must be provided with outside combustion air, except for direct vent appliances.	
Water Heaters	N1112.ABC.3	Comply with efficiency requirements in Table N1112.ABC.3. Switch or clearly marked circuit breaker electric or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.ABC.2.3	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have minimum thermal efficiency of 78%.	
Hot Water Pipes	N1112.ABC.5	Insulation is required for hot water circulating systems (including heat recovery units).	
Shower Heads	N1112.ABC.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
HVAC Duct Construction, Insulation & Installation	N1110.ABC	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated and installed in accordance with the criteria of Section N1110.ABC. Ducts in attics must be insulated to a minimum of R-6.	
HVAC Controls	N1107.ABC.2	Separate readily accessible manual or automatic thermostat for each system.	

GENERAL DIRECTIONS:

1. On Table 11C-1 indicate the R-value of the insulation being added to each component and the efficiency levels of the equipment installed. All R-values and efficiencies installed must meet or exceed the minimum values listed. Components and equipment neither being added nor renovated may be left blank.
2. ADDITIONS ONLY. Determine the percentage of new glass to conditioned floor area in the addition as follows. Total the areas of all glass windows, sliding glass doors and glass door panels. Double the area of all nonvertical roof glass and add it to the previous total. When glass in existing exterior walls is being removed or enclosed by the addition, an amount equal to the total area of this glass may be subtracted from the total glass area. Divide the adjusted glass area total by the conditioned floor area of the addition. Multiply by 100 to get the percent. Find the largest glass percentage under which your calculated percentage falls on Table 11C-2. Prescriptives are given by the type of glass (single or double pane) and the overhang (OH) paired with a solar heat gain coefficient (SHGC). For a given glass type and overhang, the minimum solar heat gain coefficient allowed is specified. Actual glass windows and doors previously in the exterior walls of the house and being reinstalled in the addition do not have to comply with the overhang and solar heat gain coefficient requirements on Table 11C-2. All new glass in the addition must meet the requirement for one of the options in the glass percentage category you indicated. The overhang (OH) distance is measured perpendicularly from the face of the glass to a point directly under the outermost edge of the overhang.
3. RENOVATIONS ONLY. Replacement glass needs to meet the following requirements. Any glass type and solar heat gain coefficient may be used for glass areas which are under at least a 2-foot overhang and whose lowest edge does not extend further than 8 feet from the overhang. Glass areas being renovated that do not meet this criteria must be either single-pane tinted, double-pane clear or double-pane tinted.
4. BUILDING SYSTEMS. Comply when new system is installed for system installed.
5. Complete the information requested on the top half of page 1.
6. Read "Minimum Requirements for Small Additions and Renovations," Table 11C-3, and check all applicable items.
7. Read, sign and date the "Owner/Agent" certification statement on page 1.

FORM 1100D-07

DESUPERHEATER, HEAT RECOVERY UNIT (HRU) WATER HEATER
EFFICIENCY CERTIFICATION

TESTS CONDUCTED IN ACCORDANCE WITH FLORIDA STANDARD FL-1

Laboratory:_____ Date of Test: _____

Report Approved By: _____ Report No: _____

Manufacturer: _____ Model No:_____

Construction Type: _____

Recommended for use with refrigeration system capacities of _____ tons.

Design Pressure: Water side _____ psig

Refrigerant side _____ psig

Test results at Standard Conditions:

Test refrigerant designation: _____

Tested at system capacity: _____ Tons

Total system hot gas superheat: _____ Btu/h

Total useful heat exchange effect:: _____ Btu/h

Water pump input: _____ Watts

NET SUPERHEAT RECOVERY: _____ %

ENERGY PERFORMANCE LEVEL (EPL) DISPLAY CARD

ESTIMATED ENERGY PERFORMANCE INDEX* =
The lower the Energy Performance Index, the more efficient the home.

1.	New Home or addition	_____
2.	Single family or multiple family	_____
3.	Number of units, (if multi-family)	_____
4.	Number of bedrooms	_____
5.	Is this a worst case? (yes or no)	_____
6.	Conditioned floor area	_____ sq. ft.
7.	Glass type & area	
	a. U-Factor: _____	_____ sq. ft.
	(Or single or double Default)	_____ sq. ft.
	b. SHGC: _____	_____ sq. ft.
	(Or clear or tint Default)	_____ sq. ft.
8.	Floor types, Insulation level	
	a. Slab-on-grade, edge insulation	R=_____
	b. Wood, raised	R=_____
	c. Concrete, raised	R=_____
9.	Wall types, Insulation level	
	Exterior	
	a. Wood frame	R=_____
	b. Metal frame	R=_____
	c. Concrete block	R=_____
	d. Log	R=_____
	e. Other _____	R=_____
	Adjacent	
	a. Wood frame	R=_____
	b. Metal frame	R=_____
	c. Concrete block	R=_____
	d. Log	R=_____
	e. Other _____	R=_____
10.	Ceiling types, Insulation level	
	a. Under attic	R=_____
	b. Single assembly	R=_____
	c. Knee walls/skylight walls	R=_____
	d. Radiant barrier installed	R=_____
11.	Ducts, Location & Insulation Level	
	a. Supply ducts: _____	R=_____
	b. Return ducts: _____	R=_____
12.	Cooling systems	Capacity: _____
	a. Split system	SEER:_____
	b. Single package	SEER:_____
	c. Ground/water source	COP:_____
	d. Room unit	EER:_____
	e. PTAC	EER:_____
	f. Gas-driven	COP:_____
13.	Heating Systems	Capacity:_____
	a. Split system heat pump	HSPF:_____
	b. Single package heat pump	HSPF:_____
	c. Electric resistance	COP:_____
	d. Gas furnace, natural gas	AFUE:_____
	e. Gas furnace, LPG	AFUE:_____
	f. Gas-driven heat pump	Recov. EFF.: _____
14.	Water heating systems	
	a. Electric resistance	EF:_____
	b. Gas fired, natural gas	EF:_____
	c. Gas fired, LPG	EF:_____
	d. Solar System with tank	EF:_____
	e. Dedicated heat pump with tank	EF:_____
	f. Heat recovery unit	HeatRec%
	g. Other: _____	_____
15.	HVAC credits claimed (Alternate Point System Method only)	
	a. Ceiling fans	_____
	b. Cross ventilation	_____
	c. Whole house fan	_____
	d. Multizone cooling credit	_____
	e. Multizone heating credit	_____
	f. Programmable thermostat	_____

I certify that this home has complied with the Florida Energy Efficiency Code For Building through the above energy saving features which will be installed (or exceeded) in this home before final inspection. Otherwise, a new EPL Display Card will be completed based on installed Code compliant features.

Builder Signature: _____ **Date:** _____

Address of New Home: _____ **City/FL Zip** _____

**NOTE: The home's estimated Energy Performance Index is available through the EnergyGauge USA FLA/RES 2007 computer program. This is not a Building Energy Rating. If your index is below 100, your home may qualify for energy efficiency mortgage (EEM) incentives if you obtain a Florida Energy Gauge Rating. Contact the EnergyGauge Hotline at (321)638-1492 or see the EnergyGauge web site at www.energygauge.com for information and a list of certified Raters. For information about Florida's Energy Efficiency Code For Building Construction, contact the Department of Community Affairs at (850)487-1824.*

**Label required by Section 13-104.4.5 of the Florida Building Code, Building, or Section B2.1.1 of Appendix G of the *Florida Building Code, Residential*, if not DEFAULT.

APPENDIX 13-E
FLORIDA STANDARD NO. 1 (FL-1)
FLORIDA REGULATORY MODIFICATIONS TO AIR-CONDITIONING & REFRIGERATION INSTITUTE (ARI) STANDARD 470-80
Effective April 1, 1986

The following regulatory modifications made to the Air-Conditioning and Refrigeration Institute (ARI) Standard 470-80 shall constitute Florida Standard FL-1 and shall be accounted for in results testing performed on heat recovery units for which credit is claimed under Chapter 6 of the *Florida Energy Code for Building Construction.* All other criteria and conditions of ARI Standard 470-80 remain in effect. Testing to the Florida regulatory modifications shall not constitute testing to ARI Standard 470-80. ARI Standard 470-80 is hereby incorporated by reference.

SECTION 1
PURPOSE

1.1.1 This standard is to be used by the industry, including manufacturers, distributors, contractors, consulting engineers, and users of desuperheater/water heaters.

SECTION 2
SCOPE

2.1 Scope. This standard applies to desuperheater/water heaters supplied as separate components, as defined in Section 3.1 for residential potable water heating.

SECTION 3
DEFINITIONS

3.1 Desuperheater/water heater. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such heat transfer relationship that the refrigerant vapor is desuper-heated and the water is heated. A water circulating pump may be included as part of the assembly.

3.2 Total useful heat exchange effect.

3.3 Total system hot gas superheat. The total heat removal required to completely desuperheat the refrigerant discharge vapor. This value is the product of the mass flow of refrigerant and the difference in enthalpy between the refrigerant vapor entering the desuperheater and the vapor at saturation leaving the desuperheater.

SECTION 4
STANDARD EQUIPMENT AND ACCESSORIES

4.1 The following items shall be required as standard equipment:

6. Installation manual, including owners' operating and maintenance instructions.

SECTION 5
TESTING AND RATING REQUIREMENTS

5.1.1 Published ratings shall state all the pertinent operating conditions and shall include the following:

d. Total useful heat exchanger effect, Btuh(W)

i. Fouling factor (water side)

Net useful heat exchange effect expressed as percent of total hot gas superheat.

j. Total system hot gas superheat.

j. [j. becomes k.]

k. [k. Becomes l.]

Note 1: If a water circulating pump is included as part of the desuperheater assembly, as value of 2545 Btu/h (746 W) per rated horsepower shall be deducted from the useful heat exchange effect (d) to arrive at actual net useful heat exchange effect, Btu/h (W). If the pump motor is rated in watts (s), such value shall be used to determine Btu/h to be deducted. For systems with no water circulating pump, the net useful heat exchange effect is equal to the total useful heat exchange effect.

5.1.2 Published ratings may also include a nominal refrigerating system capacity. The nominal system capacity in tons shall be based on a refrigerant 22 mass flow rate of 180 pounds per hour (.02268 Kg/s) per ton, and shall be given for at least one of the standard rating groups shown in Table 1. It shall be identified as to air cooled or water cooled rating.

5.2 Standard ratings. Published ratings shall include the standard rating, given for at least one of the standard rating groups shown in Table 1 and properly identified as the standard rating. standards ratings shall be cleaned ratings per 5.4.1.

5.3Application ratings. Application ratings give performance data under operating conditions other than those shown in Table 1. Application ratings shall contain all information shown in Section 5.1.1, and such ratings shall be subject to the tolerances of this standard. The publication of application ratings is optional.

5.3.1 Published application ratings may also include ratings with other fouling factors or means for determining ratings with other fouling factors. If a manufacturer elects to publish application ratings with other fouling factors, these ratings shall be determined in accordance with methods described in Section 5.4.2 and 5.4.3 below. Fouling factors shall be specified.

5.3.2 Reserved.

SECTION 7
MARKING

7.1 Each desuperheater/water heater shall have the following minimum information shown in a conspicuous place:

e. Water pump h.p. (watts), volts, amps

SECTION 8
CONFORMANCE

8.1 Conformance. All equipment represented as being in accordance with this standard shall conform to all of the provisions thereof.

Table 1. STANDARD RATING CONDITIONS

APPENDIX A. METHOD OF TESTING DESUPERHEATER/WATER HEATERS

SECTION A2
SCOPE

A2.1 Scope. This appendix applies to desuperheater/water heaters for residential potable water heating.

SECTION A3
DEFINITIONS

A3.1 Desuperheater/water heater. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such a heat transfer relationship that the refrigerant vapor is desuperheated and the water is heated. A water circulating pump may be included as part of the assembly.

A3.2 Useful heat exchanger effect. The useful heat transferred shall be the product of the mass flow of water, the specific heat and the temperature difference between entering and leaving water entering and leaving the desuperheater assembly.

A3.3 Total heat exchange effect. The total heat removed from the refrigerant in the heat exchanger. This is the sum of the useful heat exchange effect and the heat loss through the external surfaces of the heat exchanger to the ambient air.

A3.4 Total system hot gas superheat. The total heat removal required to completely desuperheat the refrigerant discharge vapor. This value is the product of the mass flow of the refrigerant and the difference in enthalpy between the refrigerant vapor entering the desuperheater and the vapor at saturation leaving the desuperheater.

SECTION A4
EXPRESSION OF TEST RESULTS

A4.1.1 Test results shall be expressed in the following terms.:

j. Refrigerant designation - R22

k. Useful heat exchange effect, percent of total system hot gas superheat, %.

l. Total system hot gas superheat, Btu/h.

SECTION A5
TEST METHODS

A5.1.1 Test shall consist of measurement of the following at specified conditions:

i. Water pump watts

j. Total system hot gas superheat, Btu/h

A5.1.2 The total useful heat transfer effect shall be determined by:

a. Multiplying the mass flow rate of water by the specific heat and temperature difference between entering and leaving water (total useful heat transfer effect).

b. Multiplying the mass flow rate of refrigerant by the enthalpy difference between entering and leaving refrigerant and adding to this the heat effect of the pump if included as part of the assembly (see NOTE 1, para. 5.1.1).

A5.1.6 Reserved.

CHAPTER 14
EXTERIOR WALLS

SECTION 1401
GENERAL

1401.1 Scope. The provisions of this chapter shall establish the minimum requirements for exterior walls, exterior wall coverings, exterior wall openings, exterior windows and doors, architectural trim, balconies and bay windows.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 1403.7 and 1408.

SECTION 1402
DEFINITIONS

1402.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

ADHERED MASONRY VENEER. Veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.

ANCHORED MASONRY VENEER. Veneer secured with approved mechanical fasteners to an approved backing.

BACKING. The wall or surface to which the veneer is secured.

EXTERIOR WALL. A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, facias, gutters and leaders.

EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

FIBER CEMENT SIDING. A manufactured, fiber-reinforcing product made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with organic or inorganic nonasbestos fibers, or both. Additives that enhance manufacturing or product performance are permitted. Fiber cement siding products have either smooth or textured faces and are intended for exterior wall and related applications.

METAL COMPOSITE MATERIAL (MCM). A factory-manufactured panel consisting of metal skins bonded to both faces of a plastic core.

METAL COMPOSITE MATERIAL (MCM) SYSTEM. An exterior wall finish system fabricated using MCM in a specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.

VENEER. A facing attached to a wall for the purpose of providing ornamentation, protection or insulation, but not counted as adding strength to the wall.

VINYL SIDING. A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used as an exterior wall covering.

WATER-RESISTIVE BARRIER. A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

SECTION 1403
PERFORMANCE REQUIREMENTS

1403.1 General. The provisions of this section shall apply to exterior walls, wall coverings and components thereof.

1403.2 Weather protection. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1405.3. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer, as described in Section 1404.2 and a means for draining water that enters the assembly to the exterior. All exterior finishes shall be applied in accordance with the manufacturer's specifications or installation instructions. Protection against condensation in the exterior wall assembly shall be provided in accordance with Chapter 13 of the *Florida Building Code, Building*.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or nonporous masonry walls designed in accordance with Chapters 19 and 21, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections 1405.2 and 1405.3, shall not be required for an exterior wall envelope that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:
   2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.

2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.

2.3. Exterior wall envelope assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (psf) (0.297 kN/m^2).

2.4. Exterior wall envelope assemblies shall be subjected to a minimum test exposure duration of 2 hours.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings or intersections of terminations with dissimilar materials.

1403.3 Structural. Exterior walls, and the associated openings, shall be designed and constructed to resist safely the superimposed loads required by Chapter 16.

1403.4 Fire resistance. Exterior walls shall be fire-resistance rated as required by other sections of this code with opening protection as required by Chapter 7.

1403.5 Flood resistance. This code specifically defers to the authority granted to local government by Title 44 CFR, Sections 59 and 60. This code is not intended to supplant or supercede local ordinances adopted pursuant to that authority, nor are local floodplain management ordinances to be deemed amendments to the code.

1403.6 Flood resistance for high-velocity wave action areas. Reserved.

1403.7 In order to provide for inspection for termite infestation, clearance between exterior wall coverings and final earth grade on the exterior of a building shall not be less than 6 inches (152 mm).

Exceptions:

1. Paint or decorative cementitious finish less than $^5/_8$ inch (17.1 mm) thick adhered directly to the masonry foundation sidewall.
2. Access or vehicle ramps which rise to the interior finish floor elevation for the width of such ramps only.
3. A 4-inch (102 mm) inspection space above patio and garage slabs and entry areas.
4. If the patio has been soil treated for termites, the finish elevation may match the building interior finish floor elevations on masonry construction only.
5. Masonry veneers.

1403.8 Drained wall assembly over mass wall assembly. Where wood frame or other types of drained wall assemblies are constructed above mass wall assemblies, flashing or other approved drainage system shall be installed as required by Section 1405.3.

SECTION 1404
MATERIALS

1404.1 General. Materials used for the construction of exterior walls shall comply with the provisions of this section. Materials not prescribed herein shall be permitted, provided that any such alternative has been approved.

1404.2 Water-resistive barrier. Exterior walls of frame construction receiving a veneer shall be provided with a water-resistive barrier. The water-resistive barrier shall be a minimum of one layer of No. 15 asphalt felt, complying with ASTM D 226 for Type 1 felt or other approved materials, shall be attached to the sheathing, with flashing as described in Section 1405.3, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.

1404.2.1 Where cement plaster (stucco) is to be applied to lath over frame construction, measures shall be taken to prevent bonding between the cement plaster and the water resistive barrier. A bond break shall be provided between the water resistive barrier and the cement plaster (stucco) consisting of one of the following:

1. Two layers of an approved water-resistant barrier or
2. One layer of an approved water-resistant barrier over an approved plastic house wrap, or
3. Other approved methods or materials applied in accordance with the manufacturer's installation instructions.

1404.3 Wood. Exterior walls of wood construction shall be designed and constructed in accordance with Chapter 23.

1404.3.1 Basic hardboard. Basic hardboard shall conform to the requirements of AHA A135.4.

1404.3.2 Hardboard siding. Hardboard siding shall conform to the requirements of AHA A135.6 and, where used structurally, shall be so identified by the label of an approved agency.

1404.4 Masonry. Exterior walls of masonry construction shall be designed and constructed in accordance with this section and Chapter 21. Masonry units, mortar and metal accessories used in anchored and adhered veneer shall meet the physical requirements of Chapter 21. The backing of anchored and adhered veneer shall be of concrete, masonry, steel framing or wood framing.

1404.5 Metal. Exterior walls of formed steel construction, structural steel or lightweight metal alloys shall be designed in accordance with Chapters 22 and 20, respectively.

1404.5.1 Aluminum siding. Aluminum siding shall conform to the requirements of AAMA 1402.

1404.5.2 Cold-rolled copper. Copper shall conform to the requirements of ASTM B 370.

1404.5.3 Lead-coated copper. Lead-coated copper shall conform to the requirements of ASTM B 101.

1404.6 Concrete. Exterior walls of concrete construction shall be designed and constructed in accordance with Chapter 19.

1404.7 Glass-unit masonry. Exterior walls of glass-unit masonry shall be designed and constructed in accordance with Chapter 21.

1404.8 Plastics. Plastic panel, apron or spandrel walls as defined in this code shall not be limited in thickness, provided that such plastics and their assemblies conform to the requirements of Chapter 26 and are constructed of approved weather-resistant materials of adequate strength to resist the wind loads for cladding specified in Chapter 16.

1404.9 Vinyl siding. Vinyl Siding and soffit shall conform to the requirements of ASTM D 3679, ASTM D 4477 and the manufacturer's installation instructions.

1404.9.1 Labeling. Vinyl siding shall be labeled as conforming to the requirements of ASTM D 3679.

1404.10 Fiber cement siding. Fiber cement siding shall conform to the requirements of ASTM C 1186 and shall be so identified on labeling listing an approved quality control agency.

SECTION 1405
INSTALLATION OF WALL COVERINGS

1405.1 General. Exterior wall coverings shall be designed and constructed in accordance with the applicable provisions of this section.

1405.2 Weather protection. Exterior walls shall provide weather protection for the building. The materials of the minimum nominal thickness specified in Table 1405.2 shall be acceptable as approved weather coverings.

1405.3 Flashing. Flashing shall be installed in such a manner so as to prevent moisture from entering the wall or to redirect it to the exterior. Flashing shall be installed at the perimeters of exterior door and window assemblies, penetrations and terminations of exterior wall assemblies, exterior wall intersections with roofs, chimneys, porches, decks, balconies and similar projections and at built-in gutters and similar locations where moisture could enter the wall. Flashing with projecting flanges shall be installed on both sides and the ends of copings, under sills and continuously above projecting trim.

1405.3.1 Exterior wall pockets. In exterior walls of buildings or structures, wall pockets or crevices in which moisture can accumulate shall be avoided or protected with caps or drips, or other approved means shall be provided to prevent water damage.

1405.3.2 Masonry. Flashing and weep holes shall be located in the first course of masonry above finished ground level above the foundation wall or slab, and other points of support, including structural floors, shelf angles and lintels where anchored veneers are designed in accordance with Section 1405.5.

1405.4 Wood veneers. Wood veneers on exterior walls of buildings of Type I, II, III and IV construction shall be not less than 1 inch (25 mm) nominal thickness, 0.438-inch (11.1 mm) exterior hardboard siding or 0.375-inch (9.5 mm) exterior-type wood structural panels or particleboard and shall conform to the following:

TABLE 1405.2
MINIMUM THICKNESS OF WEATHER COVERINGS

COVERING TYPE	MINIMUM THICKNESS (inches)
Adhered masonry veneer	0.25
Aluminum siding	0.019
Anchored masonry veneer	2.625
Asbestos-cement boards	0.125
Asbestos shingles	0.156
Cold-rolled copper[d]	0.0216 nominal
Copper shingles[d]	0.0162 nominal
Exterior plywood (with sheathing)	0.313
Exterior plywood (without sheathing)	See Section 2304.6
Fiber cement lap siding	0.25[c]
Fiber cement panel siding	0.25[c]
Fiberboard siding	0.5
Glass-fiber reinforced concrete panels	0.375
Hardboard siding[c]	0.25
High-yield copper[d]	0.0162 nominal
Lead-coated copper[d]	0.0216 nominal
Lead-coated high-yield copper	0.0162 nominal
Marble slabs	1
Particleboard (with sheathing)	See Section 2304.6
Particleboard (without sheathing)	See Section 2304.6
Precast stone facing	0.625
Steel (approved corrosion resistant)	0.0149
Stone (cast artificial)	1.5
Stone (natural)	2
Structural glass	0.344
Stucco or exterior portland cement plaster	
Three-coat work over:	
Metal plaster base	0.875[b]
Unit masonry	0.625[b]
Cast-in-place or precast concrete	0.625[b]
Two-coat work over:	
Unit masonry	0.5[b]
Cast-in-place or precast concrete	0.375[b]
Terra cotta (anchored)	1
Terra cotta (adhered)	0.25
Vinyl siding	0.035
Wood shingles	0.375
Wood siding (without sheathing)[a]	0.5

For SI: 1 inch = 25.4 mm.

a. Wood siding of thicknesses less than 0.5 inch shall be placed over sheathing that conforms to Section 2304.6.

b. Exclusive of texture.

c. As measured at the bottom of decorative grooves.

d. 16 ounces per square foot for cold-rolled copper and lead-coated copper, 12 ounces per square foot for copper shingles, high-yield copper and lead-coated high-yield copper.

1. The veneer shall not exceed three stories in height, measured from the grade plane. Where fire-retardant-treated wood is used, the height shall not exceed four stories.
2. The veneer is attached to or furred from a noncombustible backing that is fire-resistance rated as required by other provisions of this code.
3. Where open or spaced wood veneers (without concealed spaces) are used, they shall not project more than 24 inches (610 mm) from the building wall.

1405.5 Anchored masonry veneer. Anchored masonry veneer shall comply with the provisions of Sections 1405.5, 1405.6, 1405.7 and 1405.8 and Sections 6.1 and 6.2 of ACI 530/ASCE 5/TMS 402.

1405.5.1 Tolerances. Anchored masonry veneers in accordance with Chapter 14 are not required to meet the tolerances in Article 3.3 G1 of ACI 530.1/ASCE 6/TMS 602.

1405.5.2 Seismic requirements. Reserved.

1405.6 Stone veneer. Stone veneer units not exceeding 10 inches (254 mm) in thickness shall be anchored directly to masonry, concrete or to stud construction by one of the following methods:

1. With concrete or masonry backing, anchor ties shall be not less than 0.1055-inch (2.68 mm) corrosion-resistant wire, or approved equal, formed beyond the base of the backing. The legs of the loops shall be not less than 6 inches (152 mm) in length bent at right angles and laid in the mortar joint, and spaced so that the eyes or loops are 12 inches (305 mm) maximum on center (o.c.) in both directions. There shall be provided not less than a 0.1055-inch (2.68 mm) corrosion-resistant wire tie, or approved equal, threaded through the exposed loops for every 2 square feet (0.2 m^2) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length bent so that it will lie in the stone veneer mortar joint. The last 2 inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.
2. With stud backing, a 2-inch by 2-inch (51 by 51 mm) 0.0625-inch (1.59 mm) corrosion-resistant wire mesh with two layers of water-resistive barrier in accordance with Section 1404.2 shall be applied directly to wood studs spaced a maximum of 16 inches (406 mm) o.c. On studs, the mesh shall be attached with 2-inch-long (51 mm) corrosion-resistant steel wire furring nails at 4 inches (102 mm) o.c. providing a minimum 1.125-inch (29 mm) penetration into each stud and with 8d common nails at 8 inches (203 mm) o.c. into top and bottom plates or with equivalent wire ties. There shall be not less than a 0.1055-inch (2.68 mm) corrosion-resistant wire, or approved equal, looped through the mesh for every 2 square feet (0.2 m^2) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length, so bent that it will lie in the stone veneer mortar joint. The last 2 inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.

1405.7 Slab-type veneer. Slab-type veneer units not exceeding 2 inches (51 mm) in thickness shall be anchored directly to masonry, concrete or stud construction. For veneer units of marble, travertine, granite or other stone units of slab form ties of corrosion-resistant dowels in drilled holes shall be located in the middle third of the edge of the units, spaced a maximum of 24 inches (610 m) apart around the periphery of each unit with not less than four ties per veneer unit. Units shall not exceed 20 square feet (1.9 m^2) in area. If the dowels are not tight fitting, the holes shall be drilled not more than 0.063 inch (1.6 mm) larger in diameter than the dowel, with the hole countersunk to a diameter and depth equal to twice the diameter of the dowel in order to provide a tight-fitting key of cement mortar at the dowel locations when the mortar in the joint has set. Veneer ties shall be corrosion-resistant metal capable of resisting, in tension or compression, a force equal to two times the weight of the attached veneer. If made of sheet metal, veneer ties shall be not smaller in area than 0.0336 by 1 inch (0.853 by 25 mm) or, if made of wire, not smaller in diameter than 0.1483-inch (3.76 mm) wire.

1405.8 Terra cotta. Anchored terra cotta or ceramic units not less than 1.625 inches (41 mm) thick shall be anchored directly to masonry, concrete or stud construction. Tied terra cotta or ceramic veneer units shall be not less than 1.625 inches (41 mm) thick with projecting dovetail webs on the back surface spaced approximately 8 inches (203 mm) o.c. The facing shall be tied to the backing wall with corrosion-resistant metal anchors of not less than No. 8 gage wire installed at the top of each piece in horizontal bed joints not less than 12 inches (305 mm) nor more than 18 inches (457 mm) o.c.; these anchors shall be secured to 0.25-inch (6.4 mm) corrosion-resistant pencil rods that pass through the vertical aligned loop anchors in the backing wall. The veneer ties shall have sufficient strength to support the full weight of the veneer in tension. The facing shall be set with not less than a 2-inch (51 mm) space from the backing wall and the space shall be filled solidly with portland cement grout and pea gravel. Immediately prior to setting, the backing wall and the facing shall be drenched with clean water and shall be distinctly damp when the grout is poured.

1405.9 Adhered masonry veneer. Adhered masonry veneer shall comply with the applicable requirements in Section 1405.9.1 and Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS 402.

1405.9.1 Interior adhered masonry veneers. Interior adhered masonry veneers shall have a maximum weight of 20 psf (0.958 kg/m^2) and shall be installed in accordance with Section 1405.9. Where the interior adhered masonry veneer is supported by wood construction, the supporting members shall be designed to limit deflection to $^1/_{600}$ of the span of the supporting members.

1405.10 Metal veneers. Veneers of metal shall be fabricated from approved corrosion-resistant materials or shall be protected front and back with porcelain enamel, or otherwise be treated to render the metal resistant to corrosion. Such veneers shall not be less than 0.0149-inch (0.378 mm) nominal thick-

ness sheet steel mounted on wood or metal furring strips or approved sheathing on the wood construction.

1405.10.1 Attachment. Exterior metal veneer shall be securely attached to the supporting masonry or framing members with corrosion-resistant fastenings, metal ties or by other approved devices or methods. The spacing of the fastenings or ties shall not exceed 24 inches (610 mm) either vertically or horizontally, but where units exceed 4 square feet (0.4 m^2) in area there shall be not less than four attachments per unit. The metal attachments shall have a cross-sectional area not less than provided by W 1.7 wire. Such attachments and their supports shall be capable of resisting a horizontal force in accordance with the wind loads specified in Section 1609, but in no case less than 20 psf (0.958 kg/m^2).

1405.10.2 Weather protection. Metal supports for exterior metal veneer shall be protected by painting, galvanizing or by other equivalent coating or treatment. Wood studs, furring strips or other wood supports for exterior metal veneer shall be approved pressure-treated wood or protected as required in Section 1403.2. Joints and edges exposed to the weather shall be caulked with approved durable waterproofing material or by other approved means to prevent penetration of moisture.

1405.10.3 Backup. Masonry backup shall not be required for metal veneer except as is necessary to meet the fire-resistance requirements of this code.

1405.10.4 Grounding. Grounding of metal veneers on buildings shall comply with the requirements of Chapter 27.

1405.11 Glass veneer. The area of a single section of thin exterior structural glass veneer shall not exceed 10 square feet (0.93 m^2) where it is not more than 15 feet (4572 mm) above the level of the sidewalk or grade level directly below, and shall not exceed 6 square feet (0.56 m^2) where it is more than 15 feet (4572 mm) above that level.

1405.11.1 Length and height. The length or height of any section of thin exterior structural glass veneer shall not exceed 48 inches (1219 mm).

1405.11.2 Thickness. The thickness of thin exterior structural glass veneer shall be not less than 0.344 inch (8.7 mm).

1405.11.3 Application. Thin exterior structural glass veneer shall be set only after backing is thoroughly dry and after application of an approved bond coat uniformly over the entire surface of the backing so as to effectively seal the surface. Glass shall be set in place with an approved mastic cement in sufficient quantity so that at least 50 percent of the area of each glass unit is directly bonded to the backing by mastic not less than 0.25 inch (6.4 mm) thick and not more than 0.625 inch (15.9 mm) thick. The bond coat and mastic shall be evaluated for compatibility and shall bond firmly together.

1405.11.4 Installation at sidewalk level. Where glass extends to a sidewalk surface, each section shall rest in an approved metal molding, and be set at least 0.25 inch (6.4 mm) above the highest point of the sidewalk. The space between the molding and the sidewalk shall be thoroughly caulked and made water tight.

1405.11.4.1 Installation above sidewalk level. Where thin exterior structural glass veneer is installed above the level of the top of a bulkhead facing, or at a level more than 36 inches (914 mm) above the sidewalk level, the mastic cement binding shall be supplemented with approved nonferrous metal shelf angles located in the horizontal joints in every course. Such shelf angles shall be not less than 0.0478-inch (1.2 mm) thick and not less than 2 inches (51 mm) long and shall be spaced at approved intervals, with not less than two angles for each glass unit. Shelf angles shall be secured to the wall or backing with expansion bolts, toggle bolts or by other approved methods.

1405.11.5 Joints. Unless otherwise specifically approved by the building official, abutting edges of thin exterior structural glass veneer shall be ground square. Mitered joints shall not be used except where specifically approved for wide angles. Joints shall be uniformly buttered with an approved jointing compound and horizontal joints shall be held to not less than 0.063 inch (1.6 mm) by an approved nonrigid substance or device. Where thin exterior structural glass veneer abuts nonresilient material at sides or top, expansion joints not less than 0.25 inch (6.4 mm) wide shall be provided.

1405.11.6 Mechanical fastenings. Thin exterior structural glass veneer installed above the level of the heads of show windows and veneer installed more than 12 feet (3658 mm) above sidewalk level shall, in addition to the mastic cement and shelf angles, be held in place by the use of fastenings at each vertical or horizontal edge, or at the four corners of each glass unit. Fastenings shall be secured to the wall or backing with expansion bolts, toggle bolts or by other methods. Fastenings shall be so designed as to hold the glass veneer in a vertical plane independent of the mastic cement. Shelf angles providing both support and fastenings shall be permitted.

1405.11.7 Flashing. Exposed edges of thin exterior structural glass veneer shall be flashed with overlapping corrosion-resistant metal flashing and caulked with a waterproof compound in a manner to effectively prevent the entrance of moisture between the glass veneer and the backing.

1405.12 Exterior windows and doors. Windows and doors installed in exterior walls shall conform to the testing and performance requirements of Section 1714.5.

1405.12.1 Installation. Windows and doors shall be installed in accordance with approved manufacturer's instructions. Fastener size and spacing shall be provided in such instructions and shall be calculated based on maximum loads and spacing used in the tests.

1405.12.2 Window sills. In Occupancy Groups R-2 and R-3, one- and two-family and multiple-family dwellings, where the opening of the sill portion of an operable window is located more than 72 inches (1829 mm) above the finished grade or other surface below, the lowest part of the clear opening of the window shall be at a height not less than 24 inches (610 mm) above the finished floor surface of the room in which the window is located. Glazing between the floor and a height of 24 inches (610 mm) shall be fixed or

have openings through which a 4-inch (102 mm) diameter sphere cannot pass.

Exception: Openings that are provided with window guards that comply with ASTM F 2006 or F 2090.

1405.13 Vinyl siding. Vinyl siding conforming to the requirements of this section and complying with ASTM D 3679, and ASTM D 4477 in accordance with the manufacturer's installation instructions shall be permitted on exterior walls of buildings of Type V construction located in areas where the basic wind speed specified in Chapter 16 does not exceed 100 miles per hour (45 m/s) and the building height is less than or equal to 40 feet (12 192 mm) in Exposure C. Where construction is located in areas where the basic wind speed exceeds 100 miles per hour (45 m/s), or building heights are in excess of 40 feet (12 192 mm), tests or calculations indicating compliance with Chapter 16 shall be submitted. Vinyl siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.

1405.13.1 Application. The siding shall be applied over sheathing or materials listed in Section 2304.6. Siding shall be applied to conform with the water-resistive barrier requirements in Section 1403. Siding and accessories shall be installed in accordance with approved manufacturer's instructions. Unless otherwise specified in the approved manufacturer's instructions, nails used to fasten the siding and accessories shall have a minimum 0.313-inch (7.9 mm) head diameter and 0.125-inch (3.18 mm) shank diameter. The nails shall be corrosion resistant and shall be long enough to penetrate the studs or nailing strip at least 0.75 inch (19 mm). Where the siding is installed horizontally, the fastener spacing shall not exceed 16 inches (406 mm) horizontally and 12 inches (305 mm) vertically. Where the siding is installed vertically, the fastener spacing shall not exceed 12 inches (305 mm) horizontally and 12 inches (305 mm) vertically.

1405.14 Cement plaster. Cement plaster applied to exterior walls shall conform to the requirements specified in Chapter 25.

1405.15 Fiber cement siding. Fiber cement siding complying with Section 1404.10 shall be permitted on exterior walls of Type I, II, III, IV and V construction for wind pressure resistance or wind speed exposures as indicated in the manufacturer's compliance report and approved installation instructions. Where specified, the siding shall be installed over sheathing or materials listed in Section 2304.6 and shall be installed to conform to the water-resistive barrier requirements in Section 1403. Siding and accessories shall be installed in accordance with approved manufacturer's instructions. Unless otherwise specified in the approved manufacturer's instructions, nails used to fasten the siding to wood studs shall be corrosion-resistant round head smooth shank and shall be long enough to penetrate the studs at least 1 inch (25 mm). For metal framing, all-weather screws shall be used and shall penetrate the metal framing at least three full threads.

1405.16 Fastening. Weather boarding and wall coverings shall be securely fastened with aluminum, copper, zinc, zinc-coated or other approved corrosion-resistant fasteners in accordance with the nailing schedule in Table 2304.9.1 or the approved manufacturer's installation instructions. Shingles and other weather coverings shall be attached with appropriate standard-shingle nails to furring strips securely nailed to studs, or with approved mechanically bonding nails, except where sheathing is of wood not less than 1-inch (25 mm) nominal thickness or of wood structural panels as specified in Table 2308.9.3(3).

1405.17 Fiber cement siding.

1405.17.1 Panel siding. Panels shall be installed with the long dimension parallel to framing. Vertical joints shall occur over framing members and shall be sealed with caulking or covered with battens. Horizontal joints shall be flashed with Z-flashing and blocked with solid wood framing.

1405.17.2 Horizontal lap siding. Lap siding shall be lapped a minimum of $1^1/_4$ inches (32 mm) and shall have the ends sealed with caulking, covered with an H-section joint cover or located over a strip of flashing. Lap siding courses shall be permitted to be installed with the fastener heads exposed or concealed, according to approved manufacturers' instructions.

SECTION 1406
COMBUSTIBLE MATERIALS ON THE EXTERIOR SIDE OF EXTERIOR WALLS

1406.1 General. Section 1406 shall apply to exterior wall coverings; balconies and similar projections; and bay and oriel windows constructed of combustible materials.

1406.2 Combustible exterior wall coverings. Combustible exterior wall coverings shall comply with this section.

Exception: Plastics complying with Chapter 26.

1406.2.1 Ignition resistance. Combustible exterior wall coverings shall be tested in accordance with NFPA 268.

Exceptions:

1. Wood or wood-based products.
2. Other combustible materials covered with an exterior covering other than vinyl sidings listed in Table 1405.2.
3. Aluminum having a minimum thickness of 0.019 inch (0.48 mm).
4. Exterior wall coverings on exterior walls of Type V construction.

1406.2.1.1 Fire separation 5 feet or less. Where installed on exterior walls having a fire separation distance of 5 feet (1524 mm) or less, combustible exterior wall coverings shall not exhibit sustained flaming as defined in NFPA 268.

1406.2.1.2 Fire separation greater than 5 feet. For fire separation distances greater than 5 feet (1524 mm), an assembly shall be permitted that has been exposed to a reduced level of incident radiant heat flux in accordance

with the NFPA 268 test method without exhibiting sustained flaming. The minimum fire separation distance required for the assembly shall be determined from Table 1406.2.1.2 based on the maximum tolerable level of incident radiant heat flux that does not cause sustained flaming of the assembly.

TABLE 1406.2.1.2
MINIMUM FIRE SEPARATION FOR COMBUSTIBLE VENEERS

FIRE SEPARATION DISTANCE (feet)	TOLERABLE LEVEL INCIDENT RADIANT HEAT ENERGY(kW/m^2)	FIRE SEPARATION DISTANCE (feet)	TOLERABLE LEVEL INCIDENT RADIANT HEAT ENERGY(kW/m^2)
5	12.5	16	5.9
6	11.8	17	5.5
7	11.0	18	5.2
8	10.3	19	4.9
9	9.6	20	4.6
10	8.9	21	4.4
11	8.3	22	4.1
12	7.7	23	3.9
13	7.2	24	3.7
14	6.7	25	3.5
15	6.3		

For SI: 1 foot = 304.8 mm, 1 $Btu/H^2 \times °F = 0.0057\ kW/m^2 \times K$.

1406.2.2 Architectural trim. In buildings of Type I, II, III and IV construction that do not exceed three stories or 40 feet (12 192 mm) in height above grade plane, exterior wall coverings shall be permitted to be constructed of wood where permitted by Section 1405.4 or other equivalent combustible material. Combustible exterior wall coverings, other than fire-retardant-treated wood complying with Section 2303.2 for exterior installation, shall not exceed 10 percent of an exterior wall surface area where the fire separation distance is 5 feet (1524 mm) or less. Architectural trim that exceeds 40 feet (12 192 mm) in height above grade plane shall be constructed of approved noncombustible materials and shall be secured to the wall with metal or other approved noncombustible brackets.

1406.2.3 Location. Where combustible exterior wall covering is located along the top of exterior walls, such trim shall be completely backed up by the exterior wall and shall not extend over or above the top of exterior walls.

1406.2.4 Fireblocking. Where the combustible exterior wall covering is furred from the wall and forms a solid surface, the distance between the back of the covering and the wall shall not exceed 1.625 inches (41 mm) and the space thereby created shall be fireblocked in accordance with Section 717.

1406.3 Balconies and similar projections. Balconies and similar projections of combustible construction other than fire-retardant-treated wood shall be fire-resistance rated in accordance with Table 601 for floor construction or shall be of Type IV construction in accordance with Section 602.4. The aggregate length shall not exceed 50 percent of the building's perimeter on each floor.

Exceptions:

1. On buildings of Type I and II construction, three stories or less in height, fire-retardant-treated wood shall be permitted for balconies, porches, decks and exterior stairways not used as required exits.
2. Untreated wood is permitted for pickets and rails or similar guardrail devices that are limited to 42 inches (1067 mm) in height.
3. Balconies and similar projections on buildings of Type III, IV and V construction shall be permitted to be of Type V construction, and shall not be required to have a fire-resistance rating where sprinkler protection is extended to these areas.
4. Where sprinkler protection is extended to the balcony areas, the aggregate length of the balcony on each floor shall not be limited.

1406.4 Bay windows and oriel windows. Bay and oriel windows shall conform to the type of construction required for the building to which they are attached.

Exception: Fire-retardant-treated wood shall be permitted on buildings three stories or less of Type I, II, III and IV construction.

SECTION 1407
METAL COMPOSITE MATERIALS (MCM)

1407.1 General. The provisions of this section shall govern the materials, construction and quality of metal composite materials (MCM) for use as exterior wall coverings in addition to other applicable requirements of Chapters 14 and 16.

1407.1.1 Plastic core. The plastic core of the MCM shall not contain foam plastic insulation as defined in Section 2602.1.

1407.2 Exterior wall finish. MCM used as exterior wall finish or as elements of balconies and similar projections and bay and oriel windows to provide cladding or weather resistance shall comply with Sections 1407.4 through 1407.13.

1407.3 Architectural trim and embellishments. MCM used as architectural trim or embellishments shall comply with Sections 1407.7 through 1407.13.

1407.4 Structural design. MCM systems shall be designed and constructed to resist wind loads as required by Chapter 16 for components and cladding.

1407.5 Approval. Results of approved tests or an engineering analysis shall be submitted to the building official to verify compliance with the requirements of Chapter 16 for wind loads.

1407.6 Weather resistance. MCM systems shall comply with Section 1403 and shall be designed and constructed to resist wind and rain in accordance with this section and the manufacturer's installation instructions.

1407.7 Durability. MCM systems shall be constructed of approved materials that maintain the performance characteristics required in Section 1407 for the duration of use.

1407.8 Fire-resistance rating. Where MCM systems are used on exterior walls required to have a fire-resistance rating in accordance with Section 704, evidence shall be submitted to

the building official that the required fire-resistance rating is maintained.

1407.9 Surface-burning characteristics. Unless otherwise specified, MCM shall have a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E 84.

1407.10 Type I, II, III and IV construction. Where installed on buildings of Type I, II, III and IV construction, MCM systems shall comply with Sections 1407.10.1 through 1407.10.4, or 1407.11.

1407.10.1 Surface-burning characteristics. MCM shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E 84.

1407.10.2 Thermal barriers. MCM shall be separated from the interior of a building by an approved thermal barrier consisting of 0.5-inch (12.7 mm) gypsum wallboard or equivalent thermal barrier material that will limit the average temperature rise of the unexposed surface to not more than 250°F (121°C) after 15 minutes of fire exposure in accordance with the standard time-temperature curve of ASTM E 119. The thermal barrier shall be installed in such a manner that it will remain in place for not less than 15 minutes based on a test conducted in accordance with UL 1715.

1407.10.3 Thermal barrier not required. The thermal barrier specified for MCM in Section 1407.10.2 is not required where:

1. The MCM system is specifically approved based on tests conducted in accordance with UL 1040 or UL 1715. Such testing shall be performed with the MCM in the maximum thickness intended for use. The MCM system shall include seams, joints and other typical details used in the installation and shall be tested in the manner intended for use.
2. The MCM is used as elements of balconies and similar projections, architectural trim or embellishments.

1407.10.4 Full-scale tests. The MCM exterior wall assembly shall be tested in accordance with, and comply with, the acceptance criteria of NFPA 285. Such testing shall be performed on the MCM system with the MCM in the maximum thickness intended for use.

1407.11 Alternate conditions. MCM and MCM systems shall not be required to comply with Sections 1407.10.1 through 1407.10.4 provided such systems comply with Section 1407.11.1 or 1407.11.2.

1407.11.1 Installations up to 40 feet in height. MCM shall not be installed more than 40 feet (12 190 mm) in height above the grade plane where installed in accordance with Sections 1407.11.1.1 and 1407.11.1.2.

1407.11.1.1 Fire separation distance of 5 feet or less. Where the fire separation distance is 5 feet (1524 mm) or less, the area of MCM shall not exceed 10 percent of the exterior wall surface.

1407.11.1.2 Fire separation distance greater than 5 feet. Where the fire separation distance is greater than 5 feet (1524 mm), there shall be no limit on the area of exterior wall surface coverage using MCM.

1407.11.2 Installations up to 50 feet in height. MCM shall not be installed more than 50 feet (15 240 mm) in height above the grade plane where installed in accordance with Sections 1407.11.2.1 and 1407.11.2.2.

1407.11.2.1 Self ignition temperature. MCM shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929.

1407.11.2.2 Limitations. Sections of MCM shall not exceed 300 square feet (27.9 m^2) in area and shall be separated by a minimum of 4 feet (1219 mm) vertically.

1407.12 Type V construction. MCM shall be permitted to be installed on buildings of Type V construction.

1407.13 Labeling. MCM shall be labeled in accordance with Section 1703.5.

SECTION 1408
HIGH-VELOCITY HURRICANE ZONE OTHER MATERIALS

1408.1 Wood.

1408.1.1 Wood and wood products used for wall claddings shall comply with Section 2314 through 2330.

1408.1.2 Wood and wood-products used for wall cladding as non-structural exterior trim, fascia and soffits on buildings of Type I, II-A and IV. Construction may be applied to the outside of exterior walls, cornices, architectural appendages, eaves overhangs and similar projections.

Where an exterior wall is required to be fire resistive, such material shall be separated from the interior of the building by the vertical extension of the exterior wall.

1408.2 Asphalt shingles. Asphalt shingles shall be applied only to solid wood sheathing and shall be in tin-capped and spot-stuck, as set forth in Sections 1512 through 1525.

1408.3 Roll slate or felt. Roll slate or felt shall be applied only to solid wood sheathing and shall be secured by nailing, as set forth in Chapter 15, High-Velocity Hurricane Zones.

1408.4 Metal shingles. Metal shingles shall be applied only to solid wood sheathing and shall be secured as set forth in Chapter 15 (High-Velocity Hurricane Zone).

1408.5 Steel shingles. Steel Siding shall be designed and applied as set forth in Sections 2214 through 2224.

1408.6 Aluminum siding. Aluminum siding shall be designed and applied as set forth in Section 2003.

1408.7 Veneers. Masonry veneers shall be applied as set forth in Sections 2118 through 2122.

1408.8 Combustible materials. Combustible materials and fire resistive characteristics of all materials shall comply with the requirements for the group of occupancy or type of construction, and the required interior finish rating.

1408.9 Other materials. Any cladding materials or assembly not addressed in this code shall be classified by the building official as the one it most nearly resembles, and shall comply with the requirements for loading and fire resistance herein required for such materials and assemblies.

CHAPTER 15
ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION 1501
GENERAL

1501.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Section 1503.6 and Sections 1512 through 1525.

SECTION 1502
DEFINITIONS

1502.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

INTERLAYMENT. A layer of felt or nonbituminous saturated felt not less than 18 inches (457 mm) wide, shingled between each course of a wood-shake roof covering.

MECHANICAL EQUIPMENT SCREEN. A partially enclosed rooftop structure used to aesthetically conceal heating, ventilating and air conditioning (HVAC) electrical or mechanical equipment from view.

METAL ROOF PANEL. An interlocking metal sheet having a minimum installed weather exposure of 3 square feet (0.279 m^2) per sheet.

METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than 3 square feet (0.279 m^2) per sheet.

MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer-modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

PENTHOUSE. An enclosed, unoccupied structure above the roof of a building, other than a tank, tower, spire, dome cupola or bulkhead, occupying not more than one-third of the roof area.

POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

REROOFING. The process of recovering or replacing an existing roof covering. See "Roof recover" and "Roof replacement."

ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering.

ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

ROOF COVERING SYSTEM. See "Roof assembly."

ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

ROOF SECTION. A separation or division of a roof area by existing joints, parapet walls, flashing (excluding valleys), difference of elevation (excluding hips and ridges), roof type or legal description; not including the roof area required for a proper tie-off with an existing system.

ROOF VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, attics, cathedral ceilings or other enclosed spaces over which a roof assembly is installed.

ROOFTOP STRUCTURE. An enclosed structure on or above the roof of any part of a building.

SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

SINGLE-PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt or other approved material over which a steep-slope roof covering is applied.

SECTION 1503
WEATHER PROTECTION

1503.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed, installed and maintained in accordance with this code and the approved manufacturer's instructions such that the roof covering shall serve to protect the building or structure.

1503.2 Flashing. Flashing shall be installed in such a manner so as to prevent moisture entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

1503.2.1 Locations. Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction, and around roof openings.

Exception: Flashing is not required at hip and ridge junctions.

Where flashing is of metal, the metal shall be corrosion resistant with a thickness not less than provided in Table 1503.2.

TABLE 1503.2
METAL FLASHING MATERIAL

MATERIAL	MINIMUM THICKNESS (INCHES)	GAGE	WEIGHT (LBS PER SQ FT)
Copper			1 (16 oz)
Aluminum	0.024		
Stainless Steel		28	
Galvanized Steel	0.0179	26 (zinc coated G90)	
Aluminum Zinc Coated Steel	0.0179	26 (AZ50 Alum Zinc)	
Zinc Alloy	0.027		
Lead			2.5 (40 oz)
Painted Terne	----		1.25 (20 oz)

1503.3 Coping. Parapet walls shall be properly coped or sealed with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall. Metal coping shall comply with ANSI/SPRI ES-1 or RAS 111.

1503.4 Roof drainage. Unless roofs are sloped to drain over roof edges, design and installation of roof drainage systems shall comply with the *Florida Building Code, Plumbing* Chapter 11.

1503.4.1 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3, private garages and buildings of Type V construction, shall be of noncombustible material or a minimum of Schedule 40 plastic pipe.

1503.4.2 Scupper. Where required for roof drainage, a scupper shall be placed level with the roof surface in a wall or parapet. The scupper shall be located as determined by the slope and the contributing area of the roof. The exterior facing or lining of a scupper, if metal, shall be the same as flashing material required by Sections 1503 through 1510 for the particular type of covering specified for the building. For other type materials, follow manufacturer's specifications.

1503.4.3 Overflow scuppers. When other means of drainage of overflow water is not provided, overflow scuppers shall be placed in walls or parapets not less than 2 inches (51 mm) nor more than 4 inches (102 mm) above the finished roof covering and shall be located as close as practical to required vertical leaders or downspouts or wall and parapet scuppers. An overflow scupper shall be sized in accordance with the *Florida Building Code, Plumbing*.

1503.5 Roof ventilation. Attic ventilation shall be provided in accordance with Section 1203.2 and the manufacturer's installation instructions.

1503.6 Protection against decay and termites. Condensate lines and roof downspouts shall discharge at least 1 foot (305 mm) away from the structure sidewall, whether by underground piping, tail extensions, or splash blocks. Gutters with downspouts are required on all buildings with eaves of less than 6 inches (152 mm) horizontal projection except for gable end rakes or on a roof above another roof.

SECTION 1504
PERFORMANCE REQUIREMENTS

1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3 and 1504.4.

1504.1.1 Wind resistance of asphalt shingles. Asphalt shingles shall be designed for wind speeds in accordance with Section 1507.2.10.

1504.1.2 Alternative test method. Testing the acceptability of special fastening methods using the methodology in this section is permitted. The wind-induced uplift force on the shingle shall be determined using the method in UL 2390. The resistance of the shingle to the uplift force shall be determined using ASTM D 6381. Shingles passing this test shall be considered suitable for roofs located where the basic wind speed per Figure 1609 is as given in Table 1504.1.2.

Classification requires that the resistance of the shingle to wind uplift, measured using the method in ASTM D 6381, exceed the calculated load imposed by wind in the applicable zone as determined using UL 2390.

Classification by this method applies to buildings less than 60 feet (18 288 mm) high and with Wind Exposures B and C only in an Occupancy Category of I or II. Wrappers of shingle bundles that have been qualified using this alternative method shall be labeled with the tested wind classification and reference UL 2390/ASTM D 6381.

TABLE 1504.1.2
ROOF COVERING CLASSIFICATION USING ALTERNATIVE METHOD

MAXIMUM BASIC WIND SPEED (mph)	ASTM D 6381 CLASSIFICATION
90	Class D
120	Class G
150	Class H

For SI: 1 mile per hour = 0.447m/s.

1504.2 Wind resistance of clay and concrete tile. Clay and concrete tile roof coverings shall be connected to the roof deck in accordance with Chapter 16.

1504.3 Wind resistance of nonballasted roofs. Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for cladding in Chapter 16.

1504.3.1 Other roof systems. Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single-ply through fastened metal panel roof systems, and other types of membrane roof coverings shall also be tested in accordance with FM 4450, FM 4470, UL 580 or UL 1897.

1504.3.2 Metal panel roof systems. Metal panel roof systems through fastened or standing seam shall be tested in accordance with UL 580 or ASTM E 1592 or TAS 125.

Exception: Metal roofs constructed of cold-formed steel, where the roof deck acts as the roof covering and provides both weather protection and support for structural loads, shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2209.1.

1504.4 Ballasted low-slope roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings shall be designed ANSI/SPRI RP-4.

1504.5 Edge securement for low-slope roofs. Low-slope membrane roof systems metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with ANSI/SPRI ES-1 or RAS 111 except the basic wind speed shall be determined from Figure 1609.

1504.6 Physical properties. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall demonstrate physical integrity over the working life of the roof based upon 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G 152, ASTM G 153, ASTM G 155 or ASTM G 154. Those roof coverings that are subject to cyclical flexural response due to wind loads shall not demonstrate any significant loss of tensile strength for unreinforced membranes or breaking strength for reinforced membranes when tested as herein required.

1504.7 Impact resistance. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D 3746, ASTM D 4272, CGSB 37-GP-52M or the "Resistance to Foot Traffic Test" in Section 5.5 of FM 4470. All structural metal roofing systems having a thickness equal to or greater than 22 gage and all nonstructural metal roof systems having a thickness equal to or greater than 26 gage shall be exempt from the tests listed above.

1504.8 Gravel and stone. Gravel or stone shall not be used on the roof of a building located in a hurricane-prone region as defined in Section 1609.2, or on any other building with a mean roof height exceeding that permitted by Table 1504.8 based on the exposure category and basic wind speed at the building site.

TABLE 1504.8
MAXIMUM ALLOWABLE MEAN ROOF HEIGHT PERMITTED FOR BUILDINGS WITH GRAVEL OR STONE ON THE ROOF IN AREAS OUTSIDE A HURRICANE-PRONE REGION

BASIC WIND SPEED FROM FIGURE 1609 (mph)[b]	MAXIMUM MEAN ROOF HEIGHT (ft)[a,c]		
	Exposure category		
	B	C	D
85	170	60	30
90	110	35	15
95	75	20	NP
100	55	15	NP
105	40	NP	NP
110	30	NP	NP
115	20	NP	NP
120	15	NP	NP
Greater than 120	NP	NP	NP

For SI: 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. Mean roof height in accordance with Section 1609.2.

b. For intermediate values of basic wind speed, the height associated with the next higher value of wind speed shall be used, or direct interpolation is permitted.

c. NP = gravel and stone not permitted for any roof height.

1504.9 Margin of safety. A margin of safety of 2:1 shall be applied to all wind uplift resistance test results except when a margin of safety is specified in the test standard.

Exception: Asphalt shingles testing resulting in a miles per hour rating as required in Section 1507.2.10.

SECTION 1505
FIRE CLASSIFICATION

1505.1 General. Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D 2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.

TABLE 1505.1[a,b]
MINIMUM ROOF COVERING CLASSIFICATION FOR TYPES OF CONSTRUCTION

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C[c]	B	C[c]	B	B	C[c]

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Unless otherwise required in accordance with the *International* Wildland-Urban Interface Code or due to the location of the building within a fire district in accordance with Appendix D.

b. Nonclassified roof coverings shall be permitted on buildings of Group R-3 and Group U occupancies, where there is a minimum fire-separation distance of 6 feet measured from the leading edge of the roof.

c. Buildings that are not more than two stories in height and having not more than 6,000 square feet of projected roof area and where there is a minimum 10-foot fire-separation distance from the leading edge of the roof to a lot line on all sides of the building, except for street fronts or public ways, shall be permitted to have roofs of No. 1 cedar or redwood shakes and No. 1 shingles.

1505.2 Class A roof assemblies. Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

Exception: Class A roof assemblies include those with coverings of brick, masonry, slate, clay or concrete roof tile, exposed concrete roof deck, ferrous or copper shingles or panels.

1505.3 Class B roof assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be listed and identified as Class B by an approved testing agency.

Exception: Class B roof assemblies include those with coverings of metal sheets and shingles.

1505.4 Class C roof assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be listed and identified as Class C by an approved testing agency.

1505.5 Nonclassified roofing. Nonclassified roofing is approved material that is not listed as a Class A, B or C roof covering.

1505.6 Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shakes and shingles shall be treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPA C1. Each bundle shall be marked to identify the manufactured unit and the manufacturer, and shall also be labeled to identify the classification of the material in accordance with the testing required in Section 1505.1, the treating company and the quality control agency.

1505.7 Special purpose roofs. Reserved.

SECTION 1506
MATERIALS

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

1506.2 Compatibility of materials. Roofs and roof coverings shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

1506.3 Material specifications and physical characteristics. Roof-covering materials shall conform to the applicable standards listed in this chapter. In the absence of applicable standards or where materials are of questionable suitability, testing by an approved agency shall be required by the building official to determine the character, quality and limitations of application of the materials.

1506.4 Product identification. Roof-covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels required in accordance with Section 1505. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

1506.5 Nails. Nails shall be corrosion resistant nails conforming to ASTM F 1667. The corrosion resistance shall meet ASTM A 641, Class 1 or an equal corrosion resistance by coating, electro galvanization, mechanical galvanization, hot dipped galvanization, stainless steel, nonferrous metal and alloys or other suitable corrosion resistant material.

1506.6 Screws. Wood screws shall conform to ANSI/ASME B 18.6.1. Screws shall be corrosion resistant by coating, galvanization, stainless steel, nonferrous metal or other suitable corrosion-resistant material. The corrosion resistance shall be demonstrated through one of the following methods:

1. Corrosion resistance equivalent to ASTM A 641, Class 1, or
2. Corrosion resistance in accordance with TAS 114, Appendix E, or
3. Corrosion resistant coating exhibiting not more than 5 percent red rust after 1,000 hours exposure in accordance with ASTM B 117.

1506.7 Clips. Clips shall be corrosion resistant clips. The corrosion resistance shall meet 0.90 oz per sq ft (0.458 kg/m^2) measured according to ASTM A 90/A 90M, TAS 114 Appendix E or an equal corrosion resistance coating, electro galvanization, mechanical galvanization, hot dipped galvanization, stainless steel, nonferrous metals and alloys or other suitable corrosion resistant material. Stainless steel clips shall conform to ASTM A 167, Type 304.

SECTION 1507
REQUIREMENTS FOR ROOF COVERINGS

1507.1 Scope. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions.

1507.2 Asphalt shingles. The installation of asphalt shingles shall comply with the provisions of this section.

1507.2.1 Deck requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

1507.2.2 Slope. Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (17-percent slope) or greater. For roof slopes from two units vertical in 12 units horizontal (17-percent slope) up to four units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.2.8.

1507.2.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 226, Type I or Type II, or ASTM D 4869 Type I or Type II.

1507.2.4 Self-adhering polymer modified bitumen sheet. Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

1507.2.5 Asphalt shingles. Asphalt shingles shall have self-seal strips or be interlocking and comply with ASTM D 225 or ASTM D 3462. Shingles shall also comply with Table 1507.2.10. Asphalt shingle packaging shall bear labeling indicating compliance with ASTM D 3161 or a listing by an approved testing agency in accordance with the requirements of Section 1609.5.2.

1507.2.6 Fasteners. Fasteners for asphalt shingles shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12 gage [0.105 inch (2.67 mm)] shank with a minimum 0.375 inch-diameter (9.5 mm) head, of a length to penetrate through the roofing materials and a minimum of 0.75 inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than 0.75 inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F 1667.

1507.2.6.1 The nail component of plastic cap nails shall meet the corrosion resistance requirements of 1507.2.6.

1507.2.7 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer and Section 1504.1. Asphalt shingles shall be secured to the roof with not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12), asphalt shingles shall be installed in accordance with the manufacturer's printed installation instructions for steep-slope roof applications.

1507.2.8 Underlayment application. For roof slopes from two units vertical in 12 units horizontal (17-percent slope) and up to four units vertical in 12 units horizontal (33-percent slope), underlayment shall be two layers applied in the following manner. Apply a minimum 19-inch-wide (483 mm) strip of underlayment felt parallel with and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment overlapping successive sheets 19 inches (483 mm), by fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches (51 mm), fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal.

1507.2.8.1 High wind attachment. Underlayment applied in areas subject to high winds (greater than 110 mph in accordance with Figure 1609) shall be applied with corrosion- resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap at a maximum spacing of 36 inches (914 mm) on center.

1507.2.8.2 Ice dam membrane. Reserved.

1507.2.9 Flashings. Flashing for asphalt shingles shall comply with this section. Flashing shall be applied in accordance with this section and the asphalt shingle manufacturer's printed instructions.

1507.2.9.1 Base and counter flashing. Base and counter flashing shall be installed as follows:

1. In accordance with manufacturer's installation instructions, or
2. A continuous metal "L" flashing shall be set in approved flashing cement and set flush to base of wall and over the underlayment. Both horizontal and vertical metal flanges shall be fastened 6 inches (152 mm) on center with approved fasteners. All laps shall be a minimum of 4 inches (102 mm) fully sealed in approved flashing cement. Flashing shall start at the lower portion of roof to insure water-shedding capabilities of all metal laps. The entire edge of the horizontal flange shall be sealed covering all nail penetrations with approved flashing cement and membrane. Shingles will overlap the horizontal flange and shall be set in approved flashing cement.

Base flashing shall be of either corrosion resistant metal with a minimum thickness provided in Table 1503.2 or mineral surface roll roofing weighing a minimum of 77 pounds per 100 square feet (3.76 kg/m^2). Counter flashing shall be corrosion resistant metal with a minimum thickness provided in Table 1503.2.

1507.2.9.2 Valleys. Valley linings shall be installed in accordance with the manufacturer's instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valleys lined with metal, the valley lining shall be at least 16 inches (406 mm) wide and of any of the corrosion-resistant metals in Table 1503.2.
2. For open valleys, valley lining of two plies of mineral-surfaced roll roofing complying with ASTM D 6380 Class M or ASTM D 3909 shall be permitted. The bottom layer shall be 18 inches (457 mm) and the top layer a minimum of 36 inches (914 mm) wide.
3. For closed valleys, valley lining of one ply of smooth roll roofing complying with ASTM D 6380 Class S and at least 36 inches (914 mm) wide or types as described in Items 1 or 2 above shall be

permitted. Specialty underlayment complying with ASTM D 1970 may be used in lieu of the lining material.

Table 1507.2.9.2 Valley Lining Material. Reserved.

1507.2.9.3 Drip edge. Provide drip edge at eaves and gables of shingle roofs. Overlap to be a minimum of 2 inches (51 mm). Eave drip edges shall extend ½ inch (13 mm) below sheathing and extend back on the roof a minimum of 2 inches (51 mm). Drip edge at eaves shall be permitted to be installed either over or under the underlayment. If installed over the underlayment, there shall be a minimum 4 inches (51 mm) width of roof cement installed over the drip edge flange. Drip edge shall be mechanically fastened a maximum of 12 inches (305 mm) on center. Where the basic wind speed per Figure 1609 is 110 mph (177 km/h) or greater or the mean roof height exceeds 33 feet (10 058 mm), drip edges shall be mechanically fastened a maximum of 4 inches (102 mm) on center.

1507.2.9.4 Crickets or saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: Any penetration that allows water to flow around it shall not require a cricket or saddle.

1507.2.10 Wind Resistance of Asphalt Shingles. Asphalt Shingles shall be classified in accordance with ASTM D3161, TAS 107 or ASTM D7158 to resist the basic wind speed per Figure 1609. Shingles classified as ASTM D 3161 Class D or ASTM D 7158 Class G are acceptable for use in the 100-mph wind zone. Shingles classified as ASTM D3161 Class F, TAS107 or ASTM D 7158 Class H are acceptable for use in all wind zones. Asphalt shingle wrappers shall indicate compliance with one of the required classifications as shown in Table 1507.2.10.

TABLE 1507.2.10
WIND RESISTANCE OF ASPHALT SHINGLES

MAXIMUM BASIC WIND SPEED MPH (per Figure 1609)	CLASSIFICATION
100	ASTM D 3161 Class D or ASTM D 7158 Class G or TAS 107
110	ASTM D 3161 Class F or ASTM D 7158 Class G or TAS 107
120	ASTM D 3161 Class F or ASTM D 7158 Class G or TAS 107
130	ASTM D 3161 Class F or ASTM D 7158 Class H or TAS 107
140	ASTM D 3161 Class F or ASTM D 7158 Class H or TAS 107
150	ASTM D 3161 Class F or ASTM D 7158 Class H or TAS 107

1507.3 Clay and concrete tile. The installation of clay and concrete tile shall comply with the provisions of this section.

1507.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid sheathing except where the roof covering is specifically designed and tested in accordance with Section 1609.5.2 to be applied over structural spaced sheathing boards.

1507.3.2 Deck slope. Clay and concrete roof tile shall be installed in accordance with the recommendations of FRSA/RTI 07320.

1507.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform to: ASTM D 226, Type II; ASTM D 2626; ASTM D 1970 or ASTM D 6380 mineral-surfaced roll roofing. Underlayment shall be applied according to the tile manufacturer's installation instructions or the recommendations of the FRSA/TRI 07320.

1507.3.3.1 Slope and underlayment requirements. Refer to FRSA/TRI manual for underlayment and slope requirements for specific roof tile systems.

1507.3.3.2 High-slope roofs. Reserved.

1507.3.4 Clay tile. Clay roof tile shall comply with ASTM C 1167.

1507.3.5 Concrete tile. Concrete roof tile shall comply with ASTM C 1492.

1507.3.6 Fasteners. Tile fasteners shall be corrosion resistant and not less than 11 gage, $^{5}/_{16}$-inch (8.0 mm) head, and of sufficient length to penetrate the deck a minimum of 0.75 inch (19.1 mm) or through the thickness of the deck, whichever is less or in accordance with the FRSA/TRI 07320 manual. Attaching wire for clay or concrete tile shall not be smaller than 0.083 inch (2.1 mm).

1507.3.7 Attachment. Clay and concrete roof tiles shall be fastened in accordance with Section 1609 or in accordance with FRSA/TRI 07320 Installation Manual.

1507.3.8 Application. Tile shall be applied according to the manufacturer's installation instructions or recommendations of the FRSA/TRI 07320.

1507.3.9 Flashing. At the juncture of the roof vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions or the recommendations of the FRSA/TRI 07320 Manual.

1507.4 Metal roof panels. The installation of metal roof panels shall comply with the provisions of this section.

1507.4.1 Deck requirements. Metal roof panel roof coverings shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced supports.

1507.4.2 Deck slope. Minimum slopes for metal roof panels shall comply with the following:

1. The minimum slope for lapped, nonsoldered seam metal roofs without applied lap sealant shall be three units vertical in 12 units horizontal (25-percent slope).

2. The minimum slope for lapped, nonsoldered seam metal roofs with applied lap sealant shall be one-half unit vertical in 12 units horizontal (4-percent slope). Lap sealants shall be applied in accordance with the approved manufacturer's installation instructions.
3. The minimum slope for standing seam of roof systems shall be one-quarter unit vertical in 12 units horizontal (2-percent slope).

1507.4.3 Material standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet roof coverings installed over structural decking shall comply with Table 1507.4.3(1). The materials used for metal-sheet roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses shown in Table 1507.4.3(2).

TABLE 1507.4.3(2)
MINIMUM CORROSION RESISTANCE

55% Aluminum-Zinc Alloy Coated Steel	ASTM A 792 AZ 50
5% Aluminum Alloy-coated steel	ASTM A875 GF60
Aluminum-coated steel	ASTM A463 T2 65
Galvanized Steel	ASTM A 653 G-90
Prepainted Steel	ASTM A 755[a]

a. Paint systems in accordance with ASTM A 755 shall be applied over steel products with corrosion resistant coatings complying with ASTM A 792, ASTM A 875, ASTM A 463, or ASTM A 653.

1507.4.4 Attachment. Metal roof panels shall be secured to the supports in accordance with the approved manufacturer's fasteners. In the absence of manufacturer recommendations, the following fasteners shall be used:

1. Galvanized fasteners shall be used for steel roofs.
2. 300 series stainless-steel fasteners shall be used for copper roofs.

TABLE 1507.4.3(1)
METAL ROOF COVERINGS

ROOF COVERING TYPE	STANDARD	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B 209	0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-zinc coated steel	ASTM A 792	0.013 inch minimum thickness, AZ 50 (coated minimum application rate)
Cold-rolled copper	ASTM B 370	Minimum 16 oz/sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems: 12 oz/sq. ft. for preformed metal shingle systems.
Copper	ASTM B 370	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A 653	0.013 inch minimum thickness, G-90 zinc-coated[a].
Hard lead		2 lbs./sq. ft.
Lead-coated copper	ASTM B 101	
Prepainted steel	ASTM A 755	
Soft lead		3 lbs./sq. ft.
Stainless steel	ASTM A 240	300 Series Alloys
Steel	ASTM A 924	
Terne and terne-coated stainless		Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc		0.027 inch minimum thickness; 99.995% electrolytic high grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.0026 kg/m^2,
1 pound per square foot = 4.882 kg/m^2,
1 inch = 25.4 mm, 1 pound = 0.454 kg.

a. For Group U buildings, the minimum coating thickness for ASTM A 653 galvanized steel roofing shall be G-60.

3. Aluminum-zinc coated fasteners are acceptable for aluminum-zinc coated roofs.
4. Stainless-steel fasteners are acceptable for all types of metal roofs.

1507.4.5 Underlayment. Underlayment shall be installed as per manufacturer's installation guidelines.

1507.5 Metal roof shingles. The installation of metal roof shingles shall comply with the provisions of this section.

1507.5.1 Deck requirements. Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

1507.5.2 Deck slope. Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25-percent slope).

1507.5.2.1 Underlayment shall be installed as per manufacturer's installation guidelines.

1507.5.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 1970 or ASTM D 4869.

1507.5.4 Material standards. Metal roof shingle roof coverings shall comply with Table 1507.4.3(1). The materials used for metal-roof shingle roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses specified in the standards listed in Table 1507.4.3(2).

1507.5.5 Attachment. Metal roof shingles shall be secured to the roof in accordance with the approved manufacturer's installation instructions.

1507.5.6 Flashing. Roof valley flashing shall be of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in Table 1507.4.3. The valley flashing shall extend at least 8 inches (203 mm) from the centerline each way and shall have a splash diverter rib not less than 0.75 inch (19.1 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm).

1507.6 Mineral-surfaced roll roofing. The installation of mineral-surfaced roll roofing shall comply with this section.

1507.6.1 Deck requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

1507.6.2 Deck slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8-percent slope).

1507.6.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 1970 or ASTM D 4869.

1507.6.4 Material standards. Mineral-surfaced roll roofing shall conform to ASTM D 6380 Class M or Class WS or ASTM D 3909.

1507.7 Slate shingles. The installation of slate shingles shall comply with the provisions of this section.

1507.7.1 Deck requirements. Slate shingles shall be fastened to solidly sheathed roofs.

1507.7.2 Deck slope. Slate shingles shall only be used on slopes of four units vertical in 12 units horizontal (4:12) or greater.

1507.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869.

1507.7.4 Material standards. Slate shingles shall comply with ASTM C 406.

1507.7.5 Application. Minimum headlap for slate shingles shall be in accordance with Table 1507.7.5. Slate shingles shall be secured to the roof with two fasteners per slate.

TABLE 1507.7.5
SLATE SHINGLE HEADLAP

SLOPE	HEADLAP (inches)
4:12 < slope < 8:12	4
8:12 < slope < 20:12	3
slope ≥ 20:12	2

For SI: 1 inch = 25.4 mm.

1507.7.6 Flashing. Flashing and counter flashing shall be made with sheet metal. Valley flashing shall be a minimum of 16 inches (381 mm) wide. Valley and flashing metal shall be a minimum thickness provided in Table 1503.2 nonferrous metal or stainless steel.

1507.8 Wood shingles. The installation of wood shingles shall comply with the provisions of this section and Table 1507.8.

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

1507.8.1.1 Solid sheathing required. Reserved.

1507.8.2 Deck slope. Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (25-percent slope) or greater.

1507.8.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

1507.8.4 Material standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table 1507.8.4.

TABLE 1507.8.4
WOOD SHINGLE MATERIAL REQUIREMENTS

MATERIAL	APPLICABLE MINIMUM GRADES	GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	CSSB

CSSB = Cedar Shake and Shingle Bureau

1507.8.5 Attachment. Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 0.75 inch (19.1 mm) into the sheathing. For sheathing less than 0.5 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with a minimum of two fasteners.

TABLE 1507.8
WOOD SHINGLE AND SHAKE INSTALLATION

ROOF ITEM	WOOD SHINGLES	WOOD SHAKES
1. Roof slope	Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (3:12) or greater.	Wood shakes shall be installed on slopes of four units vertical in 12 units horizontal (4:12) or greater.
2. Deck requirement	—	—
Temperate climate	Shingles shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1″ × 4″ nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners.	Shakes shall be applied to roofs with solid or spaced sheathing.Where spaced sheathing is used, sheathing boards shall not be less than 1″ × 4″ nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners. When 1″ × 4″ spaced sheathing is installed at 10 inches, boards must be installed between the sheathing boards.
3. Interlayment	No requirements.	Interlayment shall comply with ASTM D 226, Type 1.
4. Underlayment	—	—
Temperate climate	Underlayment shall comply with ASTM D 226, Type 1.	Underlayment shall comply with ASTM D 226, Type 1.
5. Application	—	—
Attachment	Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.	Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.
No. of fasteners	Two per shingle.	Two per shake.
Exposure	Weather exposures shall not exceed those set forth in Table 1507.8.6	Weather exposures shall not exceed those set forth in Table 1507.9.7
Method	Shingles shall be laid with a side lap of not less than 1.5 inches between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall be 0.25 to 0.375 inch.	Shakes shall be laid with a side lap of not less than 1.5 inches between joints in adjacent courses. Spacing between shakes shall not be less than 0.375 inch or more than 0.625 inch for shakes and tapersawn shakes of naturally durable wood and shall be 0.25 to 0.375 inch for preservative taper sawn shakes.
Flashing	In accordance with Section 1507.8.7.	In accordance with Section 1507.9.8.

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

1507.8.6 Application. Wood shingles shall be laid with a side lap not less than 1.5 inches (38 mm) between joints in adjacent courses, and not be in direct alignment in alternate courses. Spacing between shingles shall be 0.25 to 0.375 inches (6.4 to 9.5 mm). Weather exposure for wood shingles shall not exceed that set in Table 1507.8.6.

TABLE 1507.8.6
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 3:12 pitch to < 4:12	EXPOSURE (inches) 4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3.75	5
		No. 2	3.5	4
		No. 3	3	3.5
	18	No. 1	4.25	5.5
		No. 2	4	4.5
		No. 3	3.5	4
	24	No. 1	5.75	7.5
		No. 2	5.5	6.5
		No. 3	5	5.5

For SI: 1 inch = 25.4 mm.

1507.8.7 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of one layer of Type I underlayment running the full length of the valley, in addition to other required underlayment.

1507.9 Wood shakes. The installation of wood shakes shall comply with the provisions of this section and Table 1507.8.

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) o.c., additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards.

1507.9.1.1 Solid sheathing required. Reserved.

1507.9.2 Deck slope. Wood shakes shall only be used on slopes of three units vertical in 12 units horizontal (33-percent slope) or greater.

1507.9.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869.

1507.9.4 Interlayment. Interlayment shall comply with ASTM D 226, Type I.

1507.9.5 Material standards. Wood shakes shall comply with the requirements of Table 1507.9.5.

TABLE 1507.9.5
WOOD SHAKE MATERIAL REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	CSSB
Taper sawn shakes of naturally durable wood	1 or 2	CSSB
Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern pine treated in accordance with AWPA U1 (Commodity Specification A, Use Category 3B and Section 5.6)	1 or 2	TFS

CSSB = Cedar Shake and Shingle Bureau.
TFS = Forest Products Laboratory of the Texas Forest Services.

1507.9.6 Attachment. Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 0.75 inch (19.1 mm) into the sheathing. For sheathing less than 0.5 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shake shall be attached with a minimum of two fasteners.

1507.9.7 Application. Wood shakes shall be laid with a side lap not less than 1.5 inches (38 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be 0.375 to 0.625 inches (9.5 to 15.9 mm) for shakes and taper sawn shakes of naturally durable wood and shall be 0.25 to 0.375 inch (6.4 to 9.5 mm) for preservative taper sawn shakes. Weather exposure for wood shakes shall not exceed those set in Table 1507.9.7.

TABLE 1507.9.7
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 4:12 PITCH OR STEEPER
Shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10[a]
Preservative-treated taper sawn shakes of Southern yellow pine	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5
Taper sawn shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5

For SI: 1 inch = 25.4 mm.
a. For 24-inch by 0.375-inch handsplit shakes, the maximum exposure is 7.5 inches.

1507.9.8 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instruc-

tions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of 3 units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of one layer of Type I underlayment running the full length of the valley, in addition to other required underlayment.

1507.10 Built-up roofs. The installation of built-up roofs shall comply with the provisions of this section.

1507.10.1 Slope. Built-up roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage, except for coal-tar built-up roofs that shall have a design slope of a minimum one-eighth unit vertical in 12 units horizontal (1-percent slope).

1507.10.2 Material standards. Built-up roof covering materials shall comply with the standards in Table 1507.10.2.

1507.10.3 Red rosin paper. Red rosin paper shall be used when the membrane is applied directly to a wood deck or cementitious fiber decks.

1507.11 Modified bitumen roofing. The installation of modified bitumen roofing shall comply with the provisions of this section.

1507.11.1 Slope. Modified bitumen membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.11.2 Material standards. Modified bitumen roof coverings shall comply with CGSB 37-GP-56M, ASTM D 6162, ASTM D 6163, ASTM D 6164, ASTM D 6222, ASTM D 6223 or ASTM D 6298.

1507.12 Thermoset single-ply roofing. The installation of thermoset single-ply roofing shall comply with the provisions of this section.

1507.12.1 Slope. Thermoset single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.12.2 Material standards. Thermoset single-ply roof coverings shall comply with ASTM D 4637, ASTM D 5019 or CGSB 37-GP-52M.

1507.13 Thermoplastic single-ply roofing. The installation of thermoplastic single-ply roofing shall comply with the provisions of this section.

1507.13.1 Slope. Thermoplastic single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope).

1507.13.2 Material standards. Thermoplastic single-ply roof coverings shall comply with ASTM D 4434, ASTM D 6754, ASTM D 6878 or CGSB CAN/CGSB 37-54.

TABLE 1507.10.2
BUILT-UP ROOFING MATERIAL STANDARDS

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D 6083
Aggregate surfacing	ASTM D 1863
Asphalt adhesive used in roofing	ASTM D 3747
Asphalt cements used in roofing	ASTM D 3019; D 2822; D 4586
Asphalt-coated glass fiber base sheet	ASTM D 4601
Asphalt coatings used in roofing	ASTM D1227; D 2823; D 4479
Asphalt glass felt	ASTM D 2178
Asphalt primer used in roofing	ASTM D 41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D 2626
Asphalt-saturated organic felt (perforated)	ASTM D 226
Asphalt used in roofing	ASTM D 312
Coal-tar cements used in roofing	ASTM D 4022; D 5643
Coal-tar saturated organic felt	ASTM D 227
Coal-tar pitch used in roofing	ASTM D 450; Type I or II
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D 43
Glass mat, coal tar	ASTM D 4990
Glass mat, venting type	ASTM D 4897
Mineral-surfaced inorganic cap sheet	ASTM D 3909
Thermoplastic fabrics used in roofing	ASTM D 5665, D 5726

1507.14 Sprayed polyurethane foam roofing. The installation of sprayed polyurethane foam roofing shall comply with the provisions of this section.

1507.14.1 Slope. Sprayed polyurethane foam roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.14.2 Material standards. Spray-applied polyurethane foam insulation shall comply with ASTM C 1029.

1507.14.3 Application. Foamed-in-place roof insulation shall be installed in accordance with the manufacturer's instructions. A liquid-applied protective coating that complies with Section 1507.15 shall be applied no less than 2 hours nor more than 72 hours following the application of the foam.

1507.14.4 Foam plastics. Foam plastic materials and installation shall comply with Chapter 26.

1507.15 Liquid-applied coatings. The installation of liquid-applied coatings shall comply with the provisions of this section.

1507.15.1 Slope. Liquid-applied roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope).

1507.15.2 Material standards. Liquid-applied roof coatings shall comply with ASTM C 836, ASTM C 957, ASTM D 1227 or ASTM D 3468, ASTM D 6083 or ASTM D 6694.

SECTION 1508
ROOF INSULATION

1508.1 General. The use of above-deck thermal insulation shall be permitted provided such insulation is covered with an approved roof covering and passes the tests of FM 4450 or UL 1256 when tested as an assembly.

Exceptions:

1. Foam plastic roof insulation shall conform to the material and installation requirements of Chapter 26.
2. Where a concrete roof deck is used and the above-deck thermal insulation is covered with an approved roof covering.

1508.1.1 Cellulosic fiberboard. Cellulosic fiberboard roof insulation shall conform to the material and installation requirements of Chapter 23.

1508.2 Material standards. Above-deck thermal insulation board shall comply with the standards in Table 1508.2.

TABLE 1508.2
MATERIAL STANDARDS FOR ROOF INSULATION

Cellular glass board	ASTM C 552
Composite boards	ASTM C 1289, Type III, IV, V or VI
Expanded polystyrene	ASTM C 578
Extruded polystyrene board	ASTM C 578
Perlite board	ASTM C 728
Polyisocyanurate board	ASTM C 1289, Type I or Type II
Wood fiberboard	ASTM C 208

SECTION 1509
ROOFTOP STRUCTURES

1509.1 General. The provisions of this section shall govern the construction of rooftop structures.

1509.2 Penthouses. A penthouse or other projection above the roof in structures of other than Type I construction shall not exceed 28 feet (8534 mm) above the roof where used as an enclosure for tanks or for elevators that run to the roof and in all other cases shall not extend more than 18 feet (5486 mm) above the roof. The aggregate area of penthouses and other rooftop structures shall not exceed one-third the area of the supporting roof. A penthouse, bulkhead or any other similar projection above the roof shall not be used for purposes other than shelter of mechanical equipment or shelter of vertical shaft openings in the roof. Provisions such as louvers, louver blades or flashing shall be made to protect the mechanical equipment and the building interior from the elements. Penthouses or bulkheads used for purposes other than permitted by this section shall conform to the requirements of this code for an additional story. The restrictions of this section shall not prohibit the placing of wood flagpoles or similar structures on the roof of any building.

1509.2.1 Type of construction. Penthouses shall be constructed with walls, floors and roof as required for the building.

Exceptions:

1. On buildings of Type I and II construction, the exterior walls and roofs of penthouses with a fire separation distance of more than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be of at least 1-hour fire-resistance-rated noncombustible construction. Walls and roofs with a fire separation distance of 20 feet (6096 mm) or greater shall be of noncombustible construction. Interior framing and walls shall be of noncombustible construction.
2. On buildings of Type III, IV and V construction, the exterior walls of penthouses with a fire separation distance of more than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be at least 1-hour fire-resistance-rated construction. Walls with a fire separation distance of 20 feet (6096 mm) or greater from a common property line shall be of Type IV or noncombustible construction. Roofs shall be constructed of materials and fire-resistance rated as required in Table 601. Interior framing and walls shall be Type IV or noncombustible construction.
3. Unprotected noncombustible enclosures housing only mechanical equipment and located with a minimum fire separation distance of 20 feet (6096 mm) shall be permitted.
4. On one-story buildings, combustible unroofed mechanical equipment screens, fences or similar enclosures are permitted where located with a fire separation distance of at least 20 feet (6096 mm) from adjacent property lines and where not exceeding 4 feet (1219 mm) in height above the roof surface.
5. Dormers shall be of the same type of construction as the roof on which they are placed, or of the exterior walls of the building.

1509.3 Tanks. Tanks having a capacity of more than 500 gallons (2 m^3) placed in or on a building shall be supported on masonry, reinforced concrete, steel or Type IV construction provided that, where such supports are located in the building above the lowest story, the support shall be fire-resistance rated as required for Type IA construction.

1509.3.1 Valve. Such tanks shall have in the bottom or on the side near the bottom, a pipe or outlet, fitted with a suitable quick opening valve for discharging the contents in an emergency through an adequate drain.

1509.3.2 Location. Such tanks shall not be placed over or near a line of stairs or an elevator shaft, unless there is a solid roof or floor underneath the tank.

1509.3.3 Tank cover. Unenclosed roof tanks shall have covers sloping toward the outer edges.

1509.4 Cooling towers. Cooling towers in excess of 250 square feet (23.2 m^2) in base area or in excess of 15 feet (4572 mm) high where located on building roofs more than 50 feet (15 240 mm) high shall be of noncombustible construction. Cooling towers shall not exceed one-third of the supporting roof area.

Exception: Drip boards and the enclosing construction of wood not less than 1 inch (25 mm) nominal thickness, provided the wood is covered on the exterior of the tower with noncombustible material.

1509.5 Towers, spires, domes and cupolas. Any tower, spire, dome or cupola shall be of a type of construction not less in fire-resistance rating than required for the building to which it is attached, except that any such tower, spire, dome or cupola that exceeds 85 feet (25 908 mm) in height above grade plane, exceeds 200 square feet (18.6 m^2) in horizontal area or is used for any purpose other than a belfry or an architectural embellishment shall be constructed of and supported on Type I or II construction.

1509.5.1 Noncombustible construction required. Any tower, spire, dome or cupola that exceeds 60 feet (18 288) in height above the highest point at which it comes in contact with the roof, or that exceeds 200 square feet (18.6 m^2) in area at any horizontal section, or which is intended to be used for any purpose other than a belfry or architectural embellishment, shall be entirely constructed of and supported by noncombustible materials. Such structures shall be separated from the building below by construction having a fire-resistance rating of not less than 1.5 hours with openings protected with a minimum 1.5-hour fire-protection rating. Structures, except aerial supports 12 feet (3658 mm) high or less, flagpoles, water tanks and cooling towers, placed above the roof of any building more than 50 feet (15 240 mm) in height, shall be of noncombustible material and shall be supported by construction of noncombustible material.

1509.5.2 Towers and spires. Towers and spires where enclosed shall have exterior walls as required for the building to which they are attached. The roof covering of spires shall be of a class of roof covering as required for the main roof of the rest of the structure.

1509.6 Equipment and appliances on roofs or elevated structures. Where equipment and appliances requiring access are installed on roofs or elevated structures at a height exceeding 16 feet (4877 mm), such access shall be provided by a permanent approved means of access, the extent of which shall be from grade or floor level to the equipment and appliances' level service space. Such access shall not require climbing over obstructions greater than 30 inches (762 mm) high or walking on roofs having a slope greater than 4 units vertical in 12 units horizontal (33-percent slope).

Permanent ladders installed to provide the required access shall comply with the following minimum design criteria:

1. The side railing shall extend above the parapet or roof edge not less than 30 inches (762 mm).
2. Ladders shall have rung spacing not to exceed 14 inches (356 mm) on center.
3. Ladders shall have a toe spacing not less than 6 inches (152 mm) deep.
4. There shall be a minimum of 18 inches (457 mm) between rails.
5. Rungs shall have a minimum 0.75-inch (19 mm) diameter and be capable of withstanding a 300-pound (136.1 kg) load.
6. Ladders over 30 feet (9144 mm) in height shall be provided with offset sections and landings capable of withstanding 100 pounds (488.2 kg/m^2) per square foot.
7. Ladders shall be protected against corrosion by approved means.

Catwalks installed to provide the required access shall be not less than 24 inches (610 mm) wide and shall have railings as required for service platforms.

Exception: This section shall not apply to Group R-3 occupancies.

1509.7 Mechanical units. Roof mounted mechanical units shall be mounted on curbs raised a minimum of 8 inches (203 mm) above the roof surface, or where roofing materials extend beneath the unit, on raised equipment supports providing a minimum clearance height in accordance with Table 1509.7.

TABLE 1509.7
CLEARANCE BELOW RAISED ROOF MOUNTED MECHANICAL UNITS

WIDTH OF MECHANICAL UNIT (inches)	SURFACES (inches)
<24	14
24 < 36	18
36 < 48	24
48 < 60	30
> 60	48

For SI: 1 inch = 25.4 mm.

SECTION 1510
REROOFING

1510.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exception: Reroofing shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.

1510.2 Structural and construction loads. Structural roof components shall be capable of supporting the roof-covering

system and the material and equipment loads that will be encountered during installation of the system.

1510.3 Recovering versus replacement. New roof coverings shall not be installed without first removing all existing layers of roof coverings where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.
4. When blisters exist in any roofing, unless blisters are cut or scraped open and remaining materials secured down before applying additional roofing.
5. Where the existing roof is to be used for attachment for a new roof system and compliance with the securement provisions of 1504.1 can not be met.

Exceptions:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
2. Reserved.
3. The application of a new protective coating over an existing spray polyurethane foam roofing system shall be permitted without tear-off of existing roof coverings.

1510.4 Roof recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

1510.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

1510.6 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

SECTION 1511
RESERVED

SECTION 1512
HIGH-VELOCITY HURRICANE ZONES—GENERAL

1512.1 Scope. Sections 1512 through 1525 set forth minimum requirements for the installation of roofing components, roofing systems, roofing assemblies and the waterproofing thereof.

1512.2 Application. These high-velocity hurricane zone roofing requirements with associated roofing application standards (RAS) and testing application standards are solely to be implemented in areas of high basic wind speeds, and where the jurisdiction having authority has adopted their use.

1512.2.1 All roofing components, roofing systems and roofing assemblies for construction regulated by this code shall comply with this chapter. All roofing components, roofing systems and roofing assemblies shall have a valid and current Product Approval. In the event that the manufacturers published literature or instructions are in conflict with those of the Product Approval, the Product Approval shall prevail. Where items specifically and expressly addressed in this chapter are in conflict with the Product Approval, the provisions of this chapter shall prevail.

1512.2.2 Innovative products and/or systems outside those currently recognized under this chapter may have a product approval issued based on performance testing; in such case(s) the conditions set in the Product Approval shall prevail.

1512.2.3 For roofing systems to be installed on a specific building or structure, where an existing Product Approval may not be applied, such roofing system may be granted a one time approval by the authority having jurisdiction, provided the applicant demonstrates, by testing and/or rational analysis that such roofing system complies with the provision of this code.

1512.2.4 Where a Product Approval does not address a detail for a specific job condition, the permit applicant may propose to the building official an alternate detail to address the specific need of the job. The building official may accept such proposal if it can be demonstrated that the provisions of this code will be met.

1512.2.5 Workmanship standards. All roofing work shall be performed by a qualified contractor licensed to perform roofing, in compliance with the tolerances, quality and methods of construction established herein or set forth in the standards adopted by these high-velocity hurricane zone requirements. Roofing assemblies detailed in the Product Approval shall be installed in strict compliance with the method of application set forth in such Product Approval or, if not part of the product approval, in compliance with manufacturer's published application instructions, or as approved by the building official. (Aesthetic issues not affecting the performance of the roof are not part of this chapter.)

1512.2.5.1 Appearance. If the architectural appearance is to be preserved from below, an alternate method of

attachment complying with the windload requirements of Chapter 16 (High-Velocity Hurricane Zones) may be proposed unless otherwise addressed in Chapter 15. The alternative attachment shall be prepared, signed and sealed by a Florida-registered architect or a Florida-registered engineer, which architect or engineer shall be proficient in structural design.

1512.3 Permits outside these high-velocity hurricane zone requirements shall comply with Section 105. Permits within high wind areas shall be required for all work in connection with the application, repair or maintenance of any roofing component or any roofing assembly and/or any of its components except as otherwise permitted in Section 105 of this code.

1512.3.1 All new roofing construction, including recovering and reroofing, repair or maintenance shall have a uniform roofing permit application, as established by the authority having jurisdiction, completed and executed by a licensed contractor.

1512.3.2 The uniform roofing permit shall include calculations per Chapter 16 (High-Velocity Hurricane Zone) of this code, unless the roofing assembly is less than the height/pressure threshold allowed in the applicable protocols herein.

1512.3.3 Reserved.

1512.3.4 Attachments to the uniform roofing permit application shall include two copies of each of the following documents: properly executed OWNERS NOTIFICATION FOR ROOFING CONSIDERATIONS herein; the fire directory listing pages, Product Approval, and applicable detail drawings; the municipal permit application; other components approvals; and any other additional data reasonably required by the authority having jurisdiction needed to determine the integrity of the roofing system.

1512.3.5 In new construction, a licensed roofing contractor may dry-in the wood deck (no mopping) on a specific structure, prior to the roofing permit being issued provided:

1512.3.5.1 The master building permit for that specific structure has been obtained;

1512.3.5.2 The sheathing inspection has been made and approved by the building official; and

1512.3.5.3 The required roofing permit application is submitted to the building official within 10 days after dry-in work is started and the slope of the roof deck is 2:12 or greater.

1512.4 Inspections performed outside these high-velocity hurricane zone requirements shall comply with Section 109.

1512.4.1 All roofing work for which a permit is required shall be inspected by the building official. One or more inspections may be performed at the same time at the request of the roofing contractor or when feasible. Lack of roofing contractor's personnel at the job site, in and of itself, shall not be cause to fail the inspection. Certain roofing inspections shall be performed during specific phases of the applications as noted below:

1512.4.2 For discontinuous roofing systems (as defined herein or Chapter 2):

1512.4.2.1 During or after application of the base sheet, anchor sheet or underlayment of any roofing system.

1512.4.2.2 During the installation of the cap sheet.

1512.4.2.3 During the installation of any prepared roof covering, such as shingles, tiles, slates, shakes and similar.

1512.4.2.4 Upon completion of all adhesive-set and mortar-set tile systems, and prior to the final inspection, a field verification and static uplift test, in compliance with TAS 106 shall be required to confirm tile adhesion to the underlayment. This test may be required by the building official for mechanically attached tile systems. All results of this test shall be submitted to the building official.

1512.4.3 For continuous roofing systems (as defined in herein or Chapter 2):

1512.4.3.1 During application of any roofing system prior to the full concealment of the adhesion/attachment process to the roof deck or to the existing roofing assembly.

1512.4.3.2 In cases where a roof area is less than 1,500 square feet (139 m^2), and when the building official is not able to perform any of the above requested inspection in a timely manner, the building official may authorize to continue with the work and may require that satisfactory evidence be provided to show that the covered work was performed in compliance with this code.

1512.4.3.3 After all roofing work has been completed, a final inspection shall be performed by the building official.

SECTION 1513
HIGH-VELOCITY HURRICANE ZONES—DEFINITIONS

1513.1 Definitions. For definitions outside Sections 1512 through 1525 and accompanied RAS and TAS, see Chapter 2. For the purposes of Sections 1512 through 1525, accompanying RAS, TAS and roofing Products Approval, roofing terms shall be defined in compliance with ASTM D 1079, unless otherwise defined below. The definitions listed below shall take preference. Other terms used herein shall be defined as set forth in Chapter 2 of this code.

AIR PERMEABLE ROOFING SYSTEM. A roofing system consisting of a prepared roof covering over an approved underlayment on a sloped roof. The components within the prepared roof covering are discontinuously laid and small, with unsealed side and head laps. Air permeable roofing systems shall be applied over sheathed decks with either mechanical attachment or a mortar/adhesive bond. Any roofing system with sealed side or head laps shall not be defined as an air permeable roofing system. The authority having jurisdiction may require testing in compliance with TAS 116, to determine whether a roofing system is air permeable.

ANCHOR SHEET. A roofing felt mechanically attached to a nailable deck with approved fasteners to which insulation is

then installed in a solid mopping of asphalt. The roofing membrane is then installed to the insulation in the usual manner.

ARCHITECTURAL METAL PANEL. Water shedding (hydrokinetic) roof panel fastened to a roof deck.

ASTM (ASTM International). A scientific and technical organization that is responsible for the development of standards on characteristics and performance of materials, products, systems, as adopted for the high-velocity hurricane zone.

NET FREE VENTILATING AREA (NFVA). The gross area of the smallest plane area of the ventilating device reduced by the percentage of physical obstruction to the plane area.

BASE SHEET. The bottom or first ply of a roofing assembly over which subsequent roofing plies are applied. A base sheet may be designed for mechanical attachment, full or partial adhesion to the substrate.

"CLASS A" ROOFING ASSEMBLY. A roofing assembly that, in combination with the roof slope, has been classified by an approved testing agency, with a listing and follow-up service, as "Class A" in compliance with ASTM E 108 or UL 790.

"CLASS B" ROOFING ASSEMBLY. A roofing assembly that, in combination with the roof slope, has been classified by an approved testing agency, with a listing and follow-up service, as "Class B" in compliance with ASTM E 108 or UL 790.

"CLASS C" ROOFING ASSEMBLY. A roofing assembly that, in combination with the roof slope, has been classified by an approved testing agency, with a listing and follow-up service, as "Class C" in compliance with ASTM E 108 or UL 790.

CONTINUOUS ROOFING SYSTEM. An impervious roof covering, composed from a single or multiple layers, forming a homogenous membrane over the entire roof surface, applied to either a flat or pitched roof surfaces.

CORROSION RESISTANT. Any component that passes appendix of FMRC's Test Standard 4470, as modified, and set forth in TAS 114.

COUNTER BATTENS. Vertical wood strips installed on sloped roofs over which horizontal battens are secured. The primary roof covering is attached or secured to these horizontal battens.

COUNTERFLASHING. Formed metal or elastomeric sheeting secured on or into a wall, curb, pipe, roof-top unit or other surface to cover and protect the upper edge of a base flashing and its associated fasteners.

DISCONTINUOUS ROOFING SYSTEM. A roofing system with unsealed overlapping components, where the combined roofing system has openings at the point of overlap, applied to a sloped surface with a pitch of 2:12, or greater. Discontinuous roofing systems include asphalt shingles; concrete, clay or metal tile; wood shingles or shakes; and cement fiber roofing systems.

DRY-IN. The process of applying the first layer of felt in a roofing system.

FMRC (Factory Mutual Research Corporation). A research and testing organization that is responsible for examination and testing of construction and other products on behalf of member insurance companies.

FASTENER WITHDRAWAL RESISTANCE TEST. A static pullout test of mechanical fasteners, which are used to anchor any roofing component, to determine the force required to withdraw a fastener from the substrate. Testing shall be in compliance with the test procedure detailed in TAS 105.

FIRE-RESISTANT ROOF COVERING. Any Class A, Class B or Class C roofing system applied to the appropriate deck type within the specified slope of the listed classification.

FLASHING. The roofing component used to seal roofing systems, where the system is interrupted or terminated.

LAP. See NRCA Manual, 4th edition.

METAL PROFILE. Including but not limited to eave and gable drip, gravel stop, raised edge systems and fascia systems. All composite and nonmetallic flashing materials shall have a Product Approval.

MINIMUM CHARACTERISTIC RESISTANCE FORCE. A force or pressure which is representative of data from withdrawal resistance testing; static uplift testing; and/or wind uplift testing after the data has been statistically analyzed to a 95-percent level of precision.

METAL ROOF PANEL. An interlocking metal sheet having an installed weather exposure equal or greater than three square feet per sheet.

METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than 3 square feet (.3 m^2) per sheet.

MOMENT. A quantity that represents the affect of a force applied at a particular point in relation to a specific point or axis.

NRCA. The NRCA *Roofing and Waterproofing Manual*, 5th edition, as published by the National Roofing Contractors Association.

PREPARED ROOF COVERING. Any manufactured or processed roof covering designed for use as the top layer of a discontinuous roofing system applied to a sloped roof.

RAS. Roofing Application Standards.

RECOVERING. The process of covering an existing roofing assembly with a new roofing system or a prepared roofing system.

REPAIR. The work of corrective procedures by replacing or altering an existing roofing component or system to eliminate water intrusion.

REROOFING. The process of recovering or replacing an existing roofing system, either in its entirety or in existing sections.

RIDGE VENT. A ventilator located within 18 inches (457 mm) of the ridge that allows the escape of warm and/or moist air from the attic area or rafter cavity.

ROOFING ACCESSORY. A type of roofing product as described in Section 1517.6 of this code.

ROOFING ASSEMBLY. An assembly of interacting roofing components [includes the roof deck, vapor retarder (if present), insulation, and roof covering].

ROOFING COATINGS, ADHESIVES AND MASTICS. Any and all liquid materials applied to the roofing membrane layer to enhance ultraviolet light resistance; increase resistance to fire; increase reflectivity of the roofing assembly; or, in some way, enhance the performance of the roofing assembly. Roofing coatings, adhesives or mastics shall not contain asbestos materials.

ROOF COVERING. An assembly of multiple field-applied components or a single component designed to weatherproof a building's top surface. A roof covering may be a roofing assembly or form a portion thereof.

ROOFING COMPONENT. A roofing product that is incorporated into various roofing assemblies.

ROOF DECK. Solid or spaced sheathing to which the roofing or waterproofing system is applied.

ROOFING MAINTENANCE. Is the work of extending the longevity of a roofing system through preventative care, such as refilling pitch pans, applying coatings, regraveling, resurfacing and recaulking.

ROOF SECTION. A separation or division of a roof area by existing expansion joints, parapet walls, flashing (excluding valleys), difference of elevation (excluding hips and ridges), roof type or legal description; not including the roof area required for a proper tie-off with an existing system.

ROOFING SYSTEM. A system of interacting roofing components, generally consisting of membrane or primary roof covering and insulation (not including the roof deck) designed to weatherproof, and sometimes to improve, the building's thermal resistance.

HIGH ROOF TILE PROFILE. Those tiles having a rise-to-width ratio greater than 0.20.

LOW ROOF TILE PROFILE. Those tiles having a rise-to-width ratio less or equal than 0.20; except those tiles meeting the flat profile definition.

FLAT ROOF TILE PROFILE. Those tiles with less than $^1/_2$-inch (12.7 mm) rise.

STRUCTURAL METAL PANEL. Roof covering intended to be self-supporting between structural members (see Sections 2003.8.2 and 2222.4).

TAS. Testing Application Standard.

UNDERLAYMENT. One or more water-shedding layers applied to a sloped roof prior to the application of a prepared roof covering. The primary purpose of an underlayment is defined as a water shedding layer to function in combination with a prepared roof covering.

WOOD SHAKES. Tapered or straight pieces of red cedar, or other wood types, of widths ranging from 3 inches to 14 inches (76 mm to 356 mm) ranging in lengths from 18 inches to 32 inches (457 mm to 813 mm) applied to a sloped roof, in conjunction with an approved underlayment, forming a discontinuous prepared roof system.

WOOD SHINGLES. Tapered pieces of red cedar, or other wood types, sawn on both faces, of widths ranging from 3 inches to 14 inches (356 mm) and lengths of 16 inches (406 mm), 18 inches (457 mm), and 24 inches (610 mm) applied to a sloped roof forming a discontinuous prepared roof system.

SECTION 1514
HIGH-VELOCITY HURRICANE ZONES—WEATHER PROTECTION

1514.1 General. Roof decks shall be covered with roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed, installed and maintained in accordance with this code and the manufacturer's installation instructions such that the roof covering shall serve to protect the building or structure. All roof coverings, roof systems and roof assemblies shall be designed and installed to resist the windload requirements of Chapter 16 (High-Velocity Hurricane Zones) of this code.

1514.2 Flashings. Flashings shall be installed in such a manner as to prevent moisture entering the wall through the joints in the coping, through moisture permeable materials, at intersections with the roof plane or at parapet wall penetrations. All roof flashing and terminations shall be designed and installed to resist the windload requirements of Chapter 16 (High-Velocity Hurricane Zone) of this code, and shall be in compliance with the provisions set forth in RAS 111.

1514.2.1 Locations. Flashings shall be installed at (1) wall and roof intersections, (2) at gutters, (3) wherever there is a change in roof slope or direction, this requirement does not apply to the hip and ridge junctions, and (4) around roof openings. Where flashing is of metal, the metal shall conform with the provisions of RAS 111.

1514.2.2 Membrane flashings. All membrane flashing shall be installed according to the roof assembly manufacturer's published literature and in accordance with the provisions set forth in RAS 111.

1514.2.3 Metal flashings and terminations. Metal flashing and terminations shall be of the material and thickness described in Section 1517.6 and RAS 111 of this code, and shall be designed and installed in accordance with RAS 111. Metal flashing shall be installed after the roofing felts have been laid and turned up the vertical surfaces, in compliance with the roofing assembly Product Approval.

1514.2.3.1 Such felts shall be embedded in hot bitumen or an approved adhesive.

1514.2.3.2 Metal surfaces shall be primed with an ASTM D 41 or ASTM D 43 primer, as appropriate and allowed to dry prior to receiving hot bitumen or cold adhesive.

1514.2.4 Metal counterflashing. Metal counterflashing shall be of the material and thickness described in Section 1517.6 and RAS 111 of this code, and shall be installed in accordance with RAS 111.

1514.2.4.1 Metal counterflashing shall be built into walls, set in reglets or applied as stucco type and shall be turned down over base flashing not less than 3 inches (76 mm).

1514.2.4.2 Metal counterflashing shall be side lapped a minimum of 4 inches (102 mm).

1514.2.4.3 Metal counterflashing, where set in reglets or surface-mounted, shall be waterproofed, in accordance with applicable application standards.

1514.2.4.4 Where metal counterflashing is used as the means of sealing (such as a vented system) it shall be set in an approved sealant, sealed with an approved adhesive on the top flange and all joints shall be sealed with an approved sealant and lapped a minimum of 4 inches (102 mm).

1514.2.5 Roof penetration flashing.

1514.2.5.1 All pipes shall be flashed with approved lead sleeve-type, pitch pans or other approved methods detailed in the roofing system assembly Product Approval. Lead flashing shall not be less than 2.5 pounds per square foot (12.2 kg/m^2). Flanges shall be a minimum of 4 inches (102 mm).

1514.2.5.2 Other roof penetrations shall be suitably flashed with curbs, collars, pitch pans, in compliance with RAS 111 or an approved method, in compliance with the roofing system assembly Product Approval.

1514.2.5.3 No roof penetration shall be located in roof valleys.

1514.3 Coping. Where required, parapet walls shall be properly coped with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall. Copings shall be designed and installed to resist the windload requirements of Chapter 16 (High-Velocity Hurricane Zones) of this code, and shall be in accordance with the provisions set forth in RAS 111.

1514.4 Roof drainage. Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof. Where required for roof drainage, scuppers shall be placed level with the roof surface in a wall or parapet. The scupper shall be located as determined by the roof slope and contributing roof area. Scuppers shall be sized in accordance with the provisions contained in ASCE 7, Section 8 with commentary and shall comply with Section 1617 herein.

1514.4.1 Gutters. Gutters and leaders placed on the outside of buildings, other than one- or two-family dwellings, private garages and buildings of Type II-B construction, shall be of noncombustible material or a minimum of Schedule 40 plastic pipe.

1514.4.1.1 Gutters and leaders shall be constructed of metal or approved plastic for outdoor exposure with lapped, soldered or caulked joints and shall be securely fastened to the building with a corrosion resistant fastening device of similar or compatible material to the gutters and downspouts. Gutters shall be in compliance with RAS 111.

1514.4.2 Overflow drains and scuppers. Where roof drains are required, overflow drains or overflow scuppers sized in accordance with *Florida Building Code, Plumbing* shall be installed with the inlet flow line located not less than 2 inches (51 mm) or more than 4 inches (102 mm) above the low point of the finished roofing surface, excluding sumps. Overflow scuppers shall be a minimum of 4 inches (102 mm) in any dimension and shall be located as close as practical to required vertical leaders, conductors or downspouts. Overflow drains and scuppers shall also comply with the *Florida Building Code, Plumbing*, and Section 1617 of this code.

1514.4.2.1 When overflow scuppers and roof drains are installed, they shall be lined with approved metal or other approved materials set forth in the roofing system assembly Product Approval.

1514.4.2.2 When recovering, reroofing or repairing an existing roof, the existing number of scuppers and/or roof drains shall not be reduced, unless a new drainage system is designed by an architect or engineer, in compliance with the provisions of this code.

1514.4.3 Sizing and discharge. Roof drains, gutters, conductors and leaders shall be sized and discharge in accordance with the *Florida Building Code, Plumbing*.

SECTION 1515
HIGH-VELOCITY HURRICANE ZONES—PERFORMANCE REQUIREMENTS

1515.1 General. All roof assemblies, roof coverings and roof systems shall have Product Approval, and shall meet the following minimum requirements.

1515.1.1 All continuous roofing assemblies shall be tested in compliance with FMRC Test Standards 4470 and/or 4471 (for metal roofing), as modified for the purposes of this code and set forth in TAS 114. Only those components listed within the roofing assembly Product Approval shall be approved for use with the roof covering. Roofing assemblies shall be acceptable for use in this code's jurisdiction providing they are in compliance with the fire classification required for the structure to which the roofing assembly is to be installed.

1515.1.2 All fastening devices and fastening assemblies used for insulation, anchor sheet or roof coverings shall be tested in compliance with Section 1523 of this code.

1515.1.3 All roofing assemblies shall be tested by a testing laboratory, certified by the certification agency in accordance with TAS 301, to confirm compliance with the fire classification and other sections of this code.

1515.1.4 All roofing membranes and components shall be tested in compliance with the physical property test requirements detailed in TAS 110.

1515.1.5 No loose laid ballasted or nonballasted system shall be allowed.

1515.2 Guidelines for roofing applications.

1515.2.1 Decks. All roofing systems and prepared roof coverings shall be installed over solid decks, unless otherwise specifically allowed in other sections of this code.

1515.2.2 Minimum slope. All roofing assemblies must be installed in compliance with the slope requirements specified in the product control approval, in compliance with Table 1515.2.

TABLE 1515.2
MINIMUM SLOPE

SYSTEM TYPE	SLOPE	
Fibrous Cement Shingles	4:12	
Metal Panels	Architectural	
	2:12	
Metal Shingles	4:12	
Tile	Mortar or Adhesive	
	2:12 (min) to 7:12 (max) unless tested for steeper slope and it is noted in Product Approval	
	Mechanically Fastened	
	Direct Deck	Battens
	4:12	
Asphaltic Shingles	Dimensional	3-tab
	2:12	2:12
Quarry Slate	$3^1/_2$:12	
Wood	Shakes	Shingles
	4:12	$3^1/_2$:12

1515.2.2.1 All roofing systems must be installed to ensure positive drainage. In new construction the minimum deck slope shall be not less than $^1/_4$:12.

1515.2.2.2 All roofing assemblies shall be installed at a slope no greater than the maximum allowed for the required fire classification.

1515.2.3 Deck preparation. All roof decks, substrates, existing roofing systems to which a new roofing assembly is to be installed shall be broom cleaned, free from dirt and silt and dry prior to commencement of the roofing application.

1515.2.3.1 Cant strips, if required, shall be extended not less than 3-inch (76 mm) up vertical flashing surfaces, measured from the top of the new roof covering.

1515.2.3.2 All eaves shall provide a firm nailable substrate for secure attachment of perimeter edge metal in compliance with RAS 111.

1515.2.3.3 Perimeter edge metal shall be fastened with nails or fasteners fabricated from similar or compatible material. The nails or fasteners shall be as set forth in the roofing assembly Product Approval.

1515.2.3.4 All precast and prestressed concrete deck components shall be leveled with leveling fill, where such components' edges are greater than $^1/_2$ inch (12.7 mm) from being flush.

1515.2.4 Impact resistance. Roof coverings installed on low slope roofs in accordance with Section 1519 shall resist impact damage based on the results of test conducted in accordance with ASTM D 3746, ASTM D 4272, CGSB 37, FM 4470 or TAS 114.

1515.2.5 Ridge vents. Ridge vents shall have a Product Approval, and shall be tested for wind driven rain in accordance with TAS 110 and Section 1523.

SECTION 1516
HIGH-VELOCITY HURRICANE ZONES—FIRE CLASSIFICATION

1516.1 General. Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire retardant treated wood roof coverings shall be tested in accordance with ASTM D 2898.

1516.2 Fire resistant roofing assemblies and coverings shall be provided on all structures. Fire classification of roofing assemblies and coverings shall be based on the exposure hazard as follows:

1516.2.1 Class A. Zero feet to 20 feet (0 to 6.1 m) distance separation measured horizontally from the closest point of any building edge to the nearest point to an adjoining structure, and all buildings with occupation greater than 300 persons.

Exception: Brick, masonry, slate, clay or concrete roof tile and exposed concrete roof deck are considered to meet Class A roof covering provisions without testing.

1516.2.2 Class B. All other structures, except as noted below

1516.2.3 Class C. Structures not occupied by humans.

SECTION 1517
HIGH-VELOCITY HURRICANE ZONES—MATERIALS

1517.1 Scope. Every roofing component shall comply with the applicable ASTM material standards adopted by this code. All such products shall bear the testing logo imprinted on the material and/or container or shall be marked in a distinctive manner to define compliance with the standards and shall be subject to be evaluated for compliance. The certification agency shall carry out random testing of labeled products to confirm compliance with ASTM material standard.

1517.2 Compatibility of materials. Roofs and roof coverings shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

1517.3 Material specification and physical characteristics. No roofing component containing asbestos shall be used in any roofing assembly.

1517.4 Product identification. All roofing components shall be labeled and/or identified as mandated by the Product Approval.

1517.4.1 ASTM standard roll goods shall be marked with a yellow line to identify the ASTM standard, or such other marking as may be deemed appropriate by the Product Approval.

1517.5 Fasteners.

1517.5.1 Nails shall be minimum 12 gage, annular ring shank nails having not less than 20 rings per inch, heads not less than $^3/_8$ inch (9.5 mm) in diameter; and lengths sufficient to penetrate through the thickness of plywood panel or wood plank decking not less than $^3/_{16}$ inch (4.8 mm), or to penetrate into a 1 inch (25 mm) or greater thickness of lumber not less than 1 inch. Nails or wood screws shall be hot dipped electro or mechanically galvanized to a thickness sufficient to resist corrosion in compliance with TAS 114, Appendix E, Section 2 (ASTM G 85). All nails shall be listed by a certification agency. All nail cartons or carton labels shall be labeled to note compliance with the corrosion resistance requirements. No roofing material shall be fully or partially adhered directly to a nailable deck, unless otherwise noted in the roof assembly Product Approval.

1517.5.2 "Tin caps" shall be not less than $1^5/_8$ inches (41 mm) and not more than 2 inches (51 mm) in diameter and of not less than 32 gage (0.010 inch) sheet metal. "Cap nails" or prefabricated fasteners with integral heads complying with this section shall be an acceptable substitute. All "tin caps," "cap nails" or prefabricated fasteners with integral heads shall be tested for corrosion resistance in compliance with TAS 114 Appendix E, Section 2 (ASTM G 85), and shall be product control listed. All of cartons or carton labels "tin caps," "cap nails" or prefabricated fasteners with integral heads shall be labeled to note compliance with the corrosion resistance requirements.

1517.6 Metal roofing accessories. All metal accessories for roofs shall be not less than 26 gage G-90 galvanized or stainless steel, 16 ounce copper, 0.025-inch (0.6 mm) thick aluminum, lead sheet with a minimum 2.5 lb/sf (12.2 kg/m^2) or equivalent noncorrosive metal alloys or composite materials manufactured for use as roof termination. All composite and nonmetallic flashing materials shall have a Product Approval.

1517.6.1 Metal accessories may be of a manufactured, shop-fabricated or field-fabricated type, providing the materials and fasteners are in compliance with the minimum requirements of this code and shall be sized, designed and installed in compliance with methods set forth in RAS 111.

1517.6.2 Gravel stop or drip edge profiles shall be as follows:

1517.6.2.1 The vertical face shall be a minimum of $1^1/_2$ inches (38 mm) and shall extend down not less than $^1/_2$ inch (12.7 mm) below the sheathing or other member immediately contiguous thereto. In all cases, the deck flange shall be not less than 2 inches (51 mm) in width. Gravel stop or drip edge shall be sized, designed and installed in compliance with RAS 111.

1517.6.2.2 Gravel stop or drip edge shall be designed so that the bottom (the kick of the metal) of the drip edge shall have a minimum of $^1/_2$-inch (12.7 mm) clearance from the structure.

1517.6.2.3 Gravel stops or eaves drip shall be installed in compliance with RAS 111.

1517.6.2.4 Gravel stops shall be installed after all roofing felts have been applied, or in compliance with the application method set forth in the roofing assembly Product Approval. All asphalt or approved cold adhesive bonding areas shall be coated with ASTM D 41 or ASTM D 43, as required, and allowed to dry prior to application.

1517.6.2.5 Gravel stops and drip edges shall be joined by lapping a minimum of 4 inches (102 mm) and the entire interior of the joints shall be coated with approved flashing cement. Cover and splice plates shall be of the same material as the gravel stop and drip edge, and shall be sized, fabricated and installed in compliance with RAS 111.

1517.6.2.6 The deck flange shall be nailed with an approved minimum 12 gage annular ring shank nail at 4 inches (102 mm) o.c. The nail shall be manufactured from similar and/or compatible material to the termination profile. All composite materials shall be fastened with nonferrous nails.

1517.6.3 Valley metal. Valley metal shall be of the materials set forth in Section 1517.6.

SECTION 1518
HIGH-VELOCITY HURRICANE ZONES—ROOF COVERINGS WITH SLOPES 2:12 OR GREATER

1518.1 General. Prepared roof coverings shall be as defined in Section 1513 and in general limited to application over sloped roof decks capable of receiving mechanical fasteners. Prepared roof coverings may be mechanically fastened or, in specific limited cases noted in the Product Approval, set in an adhesive bond.

1518.2 Underlayments. Underlayment shall be as defined in Secion1513. Underlayment shall be installed in compliance with the roofing component Product Approval and shall be in compliance with the following minimum requirements:

1518.2.1 Underlayment shall be attached to a nailable deck in a grid pattern of 12 inches (305 mm) between the overlaps, with 6-inch (152 mm) spacing at the overlaps.

1518.2.2 Where the architectural appearance of the underside is to be preserved, the underlayment shall be secured in accordance with Section 1519.5.2.

1518.2.3 Tin caps and nails or cap nails shall be applied as defined in Section 1517.5.2.

1518.2.4 Underlayment nails shall be as defined in Section 1517.5.1.

1518.3 If the underlayment is a self-adhering membrane, the membrane shall be applied over a mechanically attached anchor sheet, attached in compliance with Section 1518.2.1.

1518.4 All underlayment applications for prepared roof coverings shall be applied in compliance with the manufacturer roofing assembly Product Approval, and shall be not less than one of the following: (1) A double layer of an ASTM D 226 Type I, with a 19-inch (483 mm) headlap; or (2) A single layer of an ASTM D 226, type II with a 4-inch (102 mm) headlap; or (3) A single layer of an ASTM D 2626 coated base sheet with a 4 inch (102 mm) headlap, and (4) All endlaps shall be a minimum of 6 inches (152 mm).

1518.5 Fiber cement shingles. Fiber-cement shingles shall be applied in compliance with the shingle manufacturer's roofing assembly Product Approval. The roofing system assembly Product Approval shall meet the following minimum requirements:

1518.5.1 All nonasbestos fiber-cement shingles shall conform to ASTM C 1225.

1518.5.2 Fiber-cement shingles shall be installed in compliance with the nailing requirements set forth in the Product Approval; however, attachment of each component shall be with not less than two corrosion resistant fasteners. If adhesive is used at the head or side laps, the system shall be defined as a "sealed system" with load calculations in compliance with Chapter 16 (High-Velocity Hurricane Zones).

1518.5.3 All intersections shall be flashed in metal as provided in Section 1517.6 and RAS 111.

1518.5.4 Fiber-cement shingles shall be tested as set forth in Section 1523.

1518.6 Quarry slate. Quarry slates shall be applied in compliance with the slate manufacturer's Product Approval. The roofing assembly Product Approval shall meet the following minimum requirements:

1518.6.1 Quarry slates shall be installed with not less than two approved fasteners per slate.

1518.6.2 All terminations and intersections shall be flashed in metal as provided in Section 1517.6 and RAS 111.

1518.6.3 Quarry slates shall be tested in compliance with the requirements set forth in Section 1523.

1518.6.4 Installation of all quarry roof slates shall be limited to a roof mean height of 33 feet (10 m), unless otherwise specifically noted in the Product Approval.

1518.7 Asphaltic shingles. Asphaltic shingles layout, alignment and placement of mechanical attachment shall be in compliance with the Product Approval, and shall be installed in accordance with RAS 115.

1518.7.1 Underlayments exceeding minimum underlayments, as detailed in Section 1518, shall be applied in compliance with the application methods detailed in the Product Approval. Where the architectural appearance of the underside of the roof is to be preserved, refer to Section 1519.5.2.

1518.7.2 Installation of all asphaltic shingles shall be limited to a roof mean height of 33 feet (10 m), unless otherwise specifically noted in the Product Approval.

1518.7.3 The asphaltic shingle Product Approval shall meet the following minimum requirements.

1518.7.3.1 Where asphaltic shingles are to be installed over insulated roof deck, a suitable nailable substrate, in accordance with Section 1520.5.7 must be installed over the insulation prior to the installation of approved underlayment and shingles.

1518.7.3.2 Asphaltic shingles shall be installed in compliance with the Product Approval, but in no case with less than six approved roofing nails or approved fastening devices which penetrate through the thickness of sheathing or wood plank a minimum of $^{3}/_{16}$ inch (4.8 mm) or penetrate into a 1 inch (25 mm) or greater thickness of lumber a minimum of 1 inch (25 mm), except where architectural appearance is to be preserved, in which case a minimum of $^{3}/_{4}$ inch (19 mm) ring shank roofing nail may be used.

1518.7.3.3 Intersections, eaves, rakes, valleys, gable ends, and the starter course of asphaltic shingles shall be set in an 8-inch (203 mm) wide bed of approved cold adhesive or roofing cement. Application of adhesive or cement shall be in compliance with the application instructions of the Product Approval. Shingles shall not extend more than $^{1}/_{4}$ inch (6.4 mm) beyond the eave drip.

1518.7.3.4 All perimeter termination and valleys shall be fabricated from metal. Minimum metal requirements are set forth in Section 1517.6 and RAS 111.

1518.7.3.5 Asphaltic shingles shall be tested in compliance with the provisions set forth in Section 1523.

1518.8 Clay and concrete roof tile. Tile shall be clay, concrete or composition material of various configurations complying with the physical property requirements of this code. All tile and tile systems shall be tested in compliance with the provisions set forth in Section 1523. Tile shall have a product approval for a complete tile system, which shall include the tile, underlayment and all tile related accessories required to provide a waterproof system.

1518.8.1 Application. All tile systems shall be installed over solid sheathed decks. All tile installation shall be in accordance with RAS 118, RAS 119, and RAS 120, as applicable.

1518.8.1.1 Roof tile mortar shall either be a pre-mixed unit having a Product Approval and tested in compliance with TAS 123 or a job-site mix approved by the building official and in compliance with RAS 113.

1518.8.2 The roof tile Product Approval shall specify the slope requirement for each tile and underlayment system in accordance with Table 1515.2.

1518.8.3 All roof tile fasteners shall be tested and comply with the requirements set forth in Section 1523.

1518.8.4 All tile systems. All tile application designs shall comply with the following limitations in order to withstand the wind loads prescribed in this section, as well as all wind load requirements set forth in Chapter 16 (High-Velocity Hurricane Zones).

1518.8.4.1 Roof tile systems, combining mechanically fastened tile and mortar and/or adhesive, shall be acceptable.

1518.8.4.2 In an air permeable tile roofing systems: (1) the length of each tile shall be not less than 12 inches (305 mm) and not greater than 21 inches (533 mm) and the exposed width of the tile shall be between 8.5 inches and 15 inches (216 and 381 mm); (2) the maximum thickness of the nose (leading edge) of the tile shall not exceed 1.3 inches (33 mm); and (3) mortar or adhesive set system shall have at least two-thirds of the tile free of mortar and/or adhesive contact.

1518.8.5 The proposed method of attachment for tile systems which are considered to be air permeable, shall provide sufficient attachment resistance (Mf) (listed in tile product approval) to meet or exceed the moment of resistance (M_r) as determined by following the procedures outlined in RAS 127. The aerodynamic multiplier (k) needed in RAS 127 shall be part of the tile Product Approval and shall be derived from the following formula:

for direct deck application $k = (0.156) \times (b) \times (l)2$

for batten application $k = (0.144) \times (b) \times (l)2$

Where b (in feet) = exposed width of the tiles

Where l (in feet) = length of tiles

1518.8.6 The proposed method of attachment for tile systems which are not considered air permeable shall provide a minimum characteristic force (F') (listed in tile product control approval) to meet or exceed the required uplift resistance (Fr) as determined by following the procedures outlined in RAS 127.

1518.8.7 Tile systems shall extend beyond the drip edge (not including the rake) not less than $^3/_4$ inch (19 mm) but not more than 2 inches (51 mm).

1518.8.8 Spanish "S" tile, barrel tile or other tile systems that create a void between the deck and the underside of the tile shall be closed at the eaves with a prefabricated closure or mortar filler to close the eaves and elevate the butt ends of the first course, as detailed in the tile system Product Approval.

1518.8.9 Apply a minimum $^3/_8$-inch (9.5 mm) diameter weephole, spaced not more than 12 inches (305 mm) apart, located flush with the underlayment of all tile systems, except tile systems using thick-butt tile.

1518.8.10 Mortar or adhesive set tiles applied at an incline from 6:12 up to and including 7:12 shall have the first course of tile (this applies to pan only on two-piece barrel tile) mechanically fastened with not less than one fastener per tile. As an alternate, the first course of tile shall be applied in mortar over a single layer of minimum 20 gage galvanized wire mesh with openings of not less than $^1/_2$ inch (12.7 mm) or greater than $1^1/_2$ inches (38 mm) with minimum exposure of 12 inches (305 mm) which is mechanically attached to the deck through the underlayment with approved fasteners and tin-cap when backnailing the cap sheet. Additionally, for roof inclines of 6:12 up to and including 7:12, every third tile of every fifth course, shall be mechanically fastened with not less than one fastener per tile. For roof inclines above 7:12, in addition to the mortar or adhesive, all tiles shall be mechanically fastened with not less than one fastener per tile. Apply approved flashing cement to seal all tile fastener penetrations, for all roof inclines.

1518.8.11 All tile systems shall be shingle lapped interlocking and installed with the headlap as specified in the tile system Product Approval. In no case shall the minimum headlap be less than 2 inches (51 mm) for mortar or adhesive set tile, or less than 3 inches (76 mm) for mechanically set tile, unless restricted by product design.

1518.8.12 Where tiles are to be installed over an insulated roof deck, a suitable nailable substrate, in accordance with Sections 1520.5.6 and 1520.5.7 must be installed over the insulation prior to the installation of approved underlayment and tiles.

1518.8.13 For mortar or adhesive set tile, no more than two tiles shall be loose per roofing square [100 square feet (9.3 m^2)]. No loose tile shall be adjacent to each other.

1518.9 Metal panels/shingles. Steel panels/shingles shall be a minimum of G-90 corrosion resistant, and shall be not less than 26 gage in thickness. Aluminum panels/shingles shall not be less than 0.025-inch (0.685 mm) thick. All other metal panel/shingle products shall be an equivalent weight. All metal panel/shingle assemblies shall be capable of withstanding foot traffic without damage to the metal panels/shingles. Metal panels/shingles shall have Product Approval for a complete metal system, which shall include the panel/shingle, underlayment and all related accessories to provide a complete waterproof system.

1518.9.1 All metal panels/shingles assemblies shall be tested in accordance with Section 1523, and TAS 125.

1518.9.2 The entire application method of all metal panel/shingle systems shall be detailed in the Product Approval and RAS 133, as applicable.

1518.9.3 Metal shingles may be applied as a recover over a single layer of asphaltic shingles or smooth surface roofing, providing the deck is solid sheathed and in compliance with the provisions of this code, the existing prepared roof covering is in compliance with provisions of this code and the entire metal shingle system is applied as set forth in the Product Approval.

1518.9.4 Metal panel/shingle systems shall not extend more than 1 inch (25 mm) beyond the roof eave.

1518.9.5 All intersections shall be flashed in metal as provided in Section 1517.6, RAS 111 and the roof assembly Product Approval.

1518.10 Wood shingles and shakes. All wood shingles and shakes shall be installed in accordance with RAS 130. Installation of all wood shingles and shakes shall be limited to a roof mean height of 33 feet (10 m), unless otherwise specifically noted in the Product Approval.

1518.10.1 All wood shingle/shake systems shall be tested in accordance with Section 1523.

SECTION 1519
HIGH-VELOCITY HURRICANE ZONES—ROOF COVERINGS WITH SLOPES LESS THAN 2:12

1519.1 General. All adhered roofing components shall be bonded to the various types of substrates in compliance with the requirements set forth in the roofing assembly Product Approval and the following minimum requirements. The authority having jurisdiction may adopt RAS 150 as the means of complying with the requirements listed in this section.

1519.2 All packaged asphalt shall have the following data printed on the carton wrapper:

1519.2.1 ASTM designation and type;

1519.2.2 Flash point as determined by ASTM D 92, *Flash and Fire Point by Cleveland Open Cup*; and

1519.2.3 Equiviscous temperature (EVT) at which the asphalt attains a viscosity of 125 centipoise (25 centipoise for coal tar) as determined by ASTM D 4402, *Viscosity Determinations of Unfilled Asphalt Using The Brookfield Thermoset Apparatus.*

1519.3 Asphalt types, as defined by ASTM D 312, shall be employed in all roofing assemblies. Application of asphalt shall be in compliance with Table 1519.3A and Table 1519.3B or as detailed in the roofing assembly Product Approval.

1519.4 Back nailing of interply sheets shall not be required when using ASTM D 312 Type IV asphalt on slopes less than 3:12.

1519.5 Mechanical attachment. All mechanically attached roofing components shall be attached to the various types of substrates in compliance with the requirements set forth in the roofing assembly Product Approval and the following minimum requirements.

1519.5.1 Base sheet attachment on wood decks. Nails shall be minimum 12 gage, annular ring shank nails having not less than 20 rings per inch; heads not less than $^3/_8$ inch (9.5 mm) in diameter; and lengths sufficient to penetrate through the thickness of plywood panel or wood plank decking not less than $^3/_{16}$ inch (5 mm), or to penetrate into a 1-inch (25.4 mm), or greater, thickness of lumber not less than 1 inch (25.4 mm). Nails shall be hot dipped; electro or mechanically galvanized to a thickness sufficient to resist corrosion in compliance with Appendix E of TAS 114. All nails shall have Product Approval. All nail cartons or carton labels shall be labeled to note compliance with the corrosion resistance requirements. No roofing material shall be fully or partially adhered, unless otherwise noted in the roof assembly Product Approval directly to a nailable deck.

1519.5.1.1 Such fasteners shall be applied through "tin caps" not less than $1^5/_8$ inches (43 mm) and not more than 2 inches (51 mm) in diameter and of not less than 32 gage [0.010-inch (.25 mm)] sheet metal. All tin caps and cap nails shall be listed by the certification agency.

1519.5.1.2 Prefabricated fastener systems complying with Section 1519.5.1 and Section 1519.5.1.1 may be used, provided they are Product Approved.

1519.5.1.3 Spacing of such fasteners shall be in compliance with patterns set forth in the roofing assembly Product Approval.

1519.5.2 Where the architectural appearance of the underside is to be preserved, a base sheet may be secured in an alternate method of attachment prepared, signed, and sealed by a Florida-registered architect or engineer, or in buildings where the mean roof height does not exceed 15 feet (4.6 m), a base sheet may be secured with $1^1/_4$-inch (32 mm) fasteners on supporting members, with a minimum of $^1/_2$-inch (12.7 mm) fasteners between the supporting members, all of which shall be secured through tin caps and nailed 6 inches (152 mm) o.c. in all directions.

1519.5.3 Lightweight insulating concrete. All lightweight insulated concrete shall be vented per roofing system manufacturer recommendations.

1519.5.3.1 Lightweight concrete shall not be applied over an existing roof deck unless the supporting structure has been approved as adequate to sustain the added weight. Calculations verifying the adequacy of the existing structure to sustain the added weight shall be prepared, signed, sealed and dated by a Florida-registered architect or engineer, who is proficient in structural design, and submitted with the uniform roofing permit application.

1519.5.4 Other nailable decks. The mechanical attachment of roofing components to other nailable decks shall be governed by the roofing assembly Product Approval.

1519.6 Cast-in-place and precast structural concrete decks. Cast-in-place and precast structural concrete decks are considered non-nailable. Concrete decks shall be clean, dry and fully primed with ASTM D 41 or ASTM D 43, as required, primer applied at a rate of not less than 1 gallon (3.8 L) per square. Hot asphalt or cold adhesive shall not be applied until the primer has fully dried.

1519.6.1 In hot mopped applications over precast panels, a minimum of 12-inch (305 mm) wide strips of roofing felt or modified bitumen shall be applied to all panel joints. Said strips shall be bonded to the panel joints with asphalt, approved mastic or approved cold applied adhesive or shall be torched to a primed surface.

1519.7 Steel decks. Steel decks shall be covered with a roof insulation panel having its own Product Approval and listed in the roofing assembly product approval. Insulation panels shall be mechanically fastened in compliance with the mechanical attachment patterns listed in the roofing assembly Product Approval and in accordance with the provisions of RAS 117.

1519.7.1 If the deck thickness on an existing steel deck is less than 22 gage, a field fastener withdrawal resistance test shall be conducted in compliance with TAS 105, to confirm compliance with the wind load requirements of Chapter 16 (High-Velocity Hurricane Zones). Test results shall be submitted with the uniform roofing permit application for review prior to issuance of the roofing permit. The field fastener withdrawal resistance test shall be carried out by an approved testing laboratory.

1519.7.2 Steel decks shall be welded or mechanically attached to the structure in compliance with the design pressure requirements set forth in Chapter 16 (High-Velocity Hurricane Zones).

1519.7.3 Composite wood and insulation panels shall be mechanically attached to steel decks in compliance with the attachment requirements enumerated in the insulation roofing component Product Approval. The composite wood insulation panel shall be in compliance with the minimum sheathing requirements of this code.

1519.8 Flashing. All flashing shall be installed according to the roof assembly manufacturer's published details and literature and in accordance with RAS 111.

1519.9 Valleys. Valleys in BUR shall be installed according to the roof assembly manufacturer's published literature for high wind areas and in compliance with the applicable detail described in the Product Approval.

1519.10 Parapet walls. All parapet wall details shall be installed in accordance with the roofing system product approval, manufacturer's published details and literature and in accordance with approved methods detailed in RAS 111.

1519.11 Insulation. Roof insulation shall be applied in compliance with the roofing system Product Approval and RAS 117.

1519.12 Surfacing. Roofing assemblies shall be surfaced in compliance with the Product Approval. Surfacing shall be in sufficient quantity to comply with the required fire classification. Aggregate surfacing shall not be used on slopes greater than 3:12. Aggregate shall be embedded in a flood coat of bitumen applied over a prepared top ply.

1519.12.1 On slopes of 3:12 or less, not less than 400 pound (182 kg) of roofing gravel or 300 pounds (145 kg) of slag per square shall be applied. A minimum of 50 percent of the total aggregate shall be embedded in the flood coat of bitumen. Aggregate shall be dry and free from dirt and shall be in compliance with the sizing requirements set forth in ASTM D 1863. A building official may request a test to confirm compliance with these requirements.

1519.12.2 On inclines greater than 3:12, a smooth surface coating shall be applied.

1519.12.3 Mineral surfaced cap sheet applications shall not require any additional surfacing unless required with the particular assembly for a fire classification.

1519.12.4 All smooth surface applications shall be coated with an aluminized or emulsion coating, having a valid and current Product Approval and shall be in compliance with the application instructions in said Product Approval. Coating quantity shall be in compliance with the required fire rating classification for the structure.

1519.13 Attachment of metal termination. All edge metal and terminations shall be installed according to manufacturer's published literature, provided it meets the minimum requirements as set for in RAS 111 and Chapter 16 (High-Velocity Hurricane Zones).

1519.14 Expansion joints. Expansion joint covers and expansion joint components shall be constructed and installed in accordance with the roofing assembly manufacturer's published literature.

1519.15 Venting roofing assemblies. All roof assemblies shall be applied to a dry substrate. Vapor retarders shall be installed, where applicable, to reduce moisture vapor flow into insulation from the warm, humid building interior, leading to internal condensation. Vents shall be installed to assist in the expulsion of moisture vapor where such vapor may enter the roofing assembly or moisture, as defined in Section 1521.12. Venting units shall not allow vapor to enter the roofing assembly when the high vapor pressure side is above the roofing membrane.

1519.16 Waterproofing. Waterproofing systems may be installed in lieu of an approved roof system over sloped or hoizontal decks specifically designed for pedestrian and/or vehicular traffic, whether the deck is above occupied or unoccupied space. In new construction the minimum deck slope shall be $^1/_4$:12.

1519.16.1 The waterproofing system must possess a current and valid product approval.

1519.16.2 If an overburden or wearing surface is not to be installed, the waterproofing system must be approved by the manufacturer for use in vehicular and/or pedestrian traffic locations.

1519.16.3 The waterproofing assembly must possess a Class A, Class B or Class C fire rating as required herein.

1519.16.4 If any portion of the waterproofing membrane is to remain exposed, the waterproofing system shall be ultra-violet resistant.

1519.16.5 Flashings must be installed in accordance with the waterproofing manufacturer's published specifications and in compliance with the material and attachment standards of RAS 111.

1519.16.6 The waterproofing system shall be flood tested in accordance with ASTM D 5957.

1519.16.6.1 The flood test shall take place after installation of the waterproofing membrane and prior to the installation of any above membrane components, wearing surface or overburden.

1519.16.6.2 An approved testing lab shall provide written verification to the building official confirming that the flood test was performed along with the results, prior to final inspection.

SECTION 1520
HIGH-VELOCITY HURRICANE ZONES—ROOF INSULATION

1520.1 General. All roof insulation shall have a product approval as an approved roofing component for use in roofing assemblies. All insulation shall be tested for physical properties in accordance with TAS 110.

1520.2 Foam plastic. Foam plastic roof insulation shall conform to the material and insulation requirements of Chapter 26.

1520.2.1 Foam insulation panels shall be overlaid with a perlite, fiberglass, wood fiber or mineral wool overlay unless specifically stated to the contrary in the roof assembly Product Approval.

1520.3 Cellulose fiberboard. Cellulosic fiberboard roof insulation requirements shall conform to the materials and insulation requirements of Chapter 23.

1520.4 Insulation fasteners, membrane fasteners and stress plates. All insulation fasteners, membrane fasteners and stress plates shall have a roof component Product Approval, and shall be tested in compliance with RAS 117 Appendixes A, B and C, and TAS 110 and TAS 114, Appendix E, Section 3 (DIN 50018), for corrosion resistance.

1520.5 Application. Roof insulation shall be applied in strict compliance with the application methods detailed in the roof assembly Product Approval and with the requirements set forth in RAS 117.

1520.5.1 Roof insulation, either on the ground or on the roof top, shall be kept dry. The building official shall instruct the removal of the insulation from the job when elevated moisture levels are found in the insulation or where panels cannot achieve 85-percent adhesion.

1520.5.2 When applied in hot asphalt or cold adhesive, no insulation panel's dimension shall be greater than 4 feet (1219 mm).

1520.5.3 Strip or spot mopping of insulation panels shall be used as an application method only when approved in the roof assembly Product Approval.

1520.5.4 Where more than one layer of insulation is applied, joints between layers shall be staggered.

1520.5.5 Application in approved cold adhesive shall be as detailed in the Product Approval and shall be in compliance with the required fire classification.

1520.5.6 Nail boards or composite panels with a nailable surface may be applied to sloped decks for the application of prepared roof covering or metal roofing systems, providing that the nailing surface is minimum $^{15}/_{32}$-inch (12 mm) exterior grade plywood sheathing, and has been attached to the deck with approved fastening assemblies in accordance with the windload requirements of Chapter 16 (High-Velocity Hurricane Zones). Composite panels shall be gapped a minimum of $^{1}/_{8}$ inch (3.2 mm) to allow for expansion of the sheathing panel.

1520.5.7 Suitable nailable decks installed over rigid board roof insulation in buildings of mean roof height of 35 feet (10.7 m) or less, shall be a minimum of $^{15}/_{32}$-inch (12 mm) exterior grade plywood sheathing. These decks shall be fastened to every structural roof frame member or to the existing deck under the insulation, at intervals of not more than 24 inches (610 mm) apart, with a minimum #12 approved insulation fastener spaced at a maximum of 12 inches (305 mm) apart in one direction with a minimum penetration of $1^{1}/_{2}$ inches (38 mm) into the structural member or deck. In these cases the maximum thickness of the rigid insulation board shall not exceed 2 inches (51 mm). An alternate method of attachment may be proposed, provided it is in compliance with Chapter 16 (High-Velocity Hurricane Zones), and it is prepared, signed and sealed by a Florida-registered architect or a Florida professional engineer, which architect or engineer shall be proficient in structural design.

1520.5.8 Mechanical attachment of insulation panels at uneven areas shall be acceptable. Hollowing, cutting or scoring of insulation panels to provide contact shall not be acceptable.

SECTION 1521
HIGH-VELOCITY HURRICANE ZONES—REROOFING

1521.1 General. Materials and methods of application used for recovering or replacing an existing roof covering, system or assembly shall comply with the requirements set forth in Sections 1512 through 1525.

1521.2 Repairs shall be carried out with roofing components as defined in this chapter having a Product Approval.

1521.3 Repairs shall be carried out in such a manner as to not create additional ponding water.

1521.4 Not more than 25 percent of the total roof area or roof section of any existing building or structure shall be repaired, replaced or recovered in any 12-month period unless the entire existing roofing system or roof section is replaced to conform to requirements of this code.

1521.5 A roofing system shall not be applied over an existing roof or over an existing roof deck where the roof sheathing has not been fastened in compliance with this code or where the roof sheathing will not permit effective fastening or where sheathing is water soaked or deteriorated so that effective attachment is not possible. All areas of deteriorated sheathing shall be removed and replaced. The building official shall not be required to inspect the renailing of the sheathing under this section.

1521.6 Structural concrete decks shall be allowed to dry or shall be dried prior to application of an ASTM D 41 or ASTM D 43, as required, or roofing system proprietary primer where the base sheet or base insulation layer is bonded to the concrete deck.

1521.7 On lightweight concrete, gypsum and cementitious wood fiber roof decks a field fastener withdrawal resistance test, in compliance with TAS 105, shall be carried out to confirm compliance with wind load requirements of Chapter 16 (High-Velocity Hurricane Zones).

1521.7.1 If the tested fasteners exhibit a minimum characteristic resistance force less than 80 percent than that listed in the Product Approval, a structural engineer shall examine the deck's integrity and provide a proposed attachment specification. Such specification shall be submitted with the uniform roofing permit application for review and approval by the building official prior to the issuance of a roofing permit. Calculations for the attachment of the anchor sheet/base sheet or insulation over these deck types, shall be in compliance with RAS 117.

1521.8 Steel decks shall be examined prior to recover for indication of corrosion. Any corrosion shall be treated with a rust inhibitor, providing the field fastener withdrawal resistance values of the proposed mechanical fasteners comply with the requirements of Chapter 16 (High-Velocity Hurricane Zone) of this code. All steel decks less than 22 gage shall be field tested for fastener withdrawal resistance for compliance with Chapter 16 (High-Velocity Hurricane Zones) prior to application of a new roofing system. Test results shall be submitted with the uniform roofing permit application.

1521.9 One additional roofing system may be applied over an original roofing assembly, providing the existing roofing assembly complies with the requirements of Section 1521.

1521.10 If the recover roofing assembly is to be bonded to an existing roofing membrane, the existing roofing membrane shall be tested in compliance with TAS 124 for uplift resistance. The existing roofing membrane shall resist the design pressures calculated under Chapter 16 (High-Velocity Hurricane Zones) of this code. Test results shall be submitted with the uniform roofing permit application.

1521.11 If the recover roofing assembly is mechanically attached through either a base sheet or insulation layer, the attachment assembly shall be field tested for fastener withdrawal resistance, in compliance with TAS 105, and laboratory tested for pull-over resistance to insure compliance with wind uplift requirements set forth in Chapter 16 (High-Velocity Hurricane Zones) of this code. Test results shall be submitted with the uniform roofing permit application. Recover roofing assembly anchor sheet or base sheet shall not be mechanically fastened directly to existing gravel roof unless all gravel is completely removed.

1521.12 Moisture content of the existing roofing assembly to be covered by a new roofing system shall not exceed 5 percent by weight in the roofing membrane and 8 percent by weight in commercially manufactured rigid board roof insulation as verified by moisture survey performed in accordance with TAS 126. Test results shall be submitted with the Uniform Roofing Permit Application.Testing for moisture content shall not be required for existing lightweight insulating concrete, gypsum, and cementious wood fiber roof decks. All existing lightweight insulating concrete, gypsum and cementious wood fiber roof decks shall be tested per Section 1521.7 to confirm compliance with wind load requirements of Chapter 16 (High-Velocity Hurricane Zones).

1521.13 Prior to starting the work the contractor has the responsibility of notifying the owner, by means of the roofing permit and required owners notification for roofing considerations herein, of any possibility of ponding water and recommend a structural review if ponding water is a possibility.

1521.14 If the new roofing system is to be bonded to the existing roof surface, the surface shall be free of all loose gravel, dirt and silt and dry prior to commencement of the roofing application. All blisters shall be cut and repaired prior to roofing application.

1521.14.1 If the existing roof surface has gravel embedded in hot asphalt, all loose gravel shall be removed together with any dirt and silt. The dry membrane surface shall be primed with ASTM D 41 primer or proprietary roofing system primer and allowed to dry thoroughly. A flood coat of ASTM D 312, type III or IV asphalt shall be applied to sufficient depth to cover the remaining embedded gravel. The prepared substrate shall be suitable for application of a new insulation layer only.

1521.14.2 In the case of existing coal tar assemblies, the existing roof surface shall be primed with ASTM D 43 primer or covered with a mechanically attached separation board prior to application of a new coal tar assembly. If an existing coal tar assembly is to be covered with an asphalt applied roofing system, only the separation board is acceptable. The attachment of the entire assembly, including the separation board, shall meet the design pressure requirements set forth in Chapter 16 (High-Velocity Hurricane Zones).

1521.14.3 Insulation shall have a Product Approval as a roofing component approved for use as a part of the roofing assembly. The insulation panels shall be bonded or mechanically attached in compliance with the Product Approval and RAS 117.

1521.15 Where an existing sloped roof is sheathed with spaced sheathing, any existing prepared roof covering shall be removed. New sheathing shall be applied in compliance with Chapter 16 (High-Velocity Hurricane Zones), or open spacing shall be filled with dimensional lumber to create solid wood sheathing providing the spaced sheathing is in compliance with this code. Spaced sheathing is approved for use with wood shakes and wood shingles only.

1521.16 No recover application shall take place over existing wood shingles, shakes, slate, tile or metal shingles.

1521.17 Asphaltic shingle assemblies may be applied over one existing layer of asphaltic shingles having not more than $^1/_8$-inch (3.2 mm) difference in level in the existing shingle material. Recover over an existing shingle system shall be with a product having a Product Approval as prepared roof covering, in strict compliance with the application method detailed in the product approval.

1521.18 Sprayed polyurethane foam (PUF) and elastomeric coating systems may be applied over existing roofing assemblies providing the PUF system has obtained a product approval, the deck has been prepared in compliance with the product approval and this code, the application is in strict compliance with the foam manufacturer's published application instructions for the environmental conditions at the time of application and post-application inspections conform to RAS 109.

1521.18.1 No PUF and/or elastomeric coating systems shall be applied over existing composition shingles.

1521.18.2 Upon completion of a PUF system, an inspection of the system shall be carried out by an authorized representative of the coating manufacturer. A certification shall be furnished to the building official within 30 days of completion, confirming that the quality control tests detailed in the PUF system Product Approval have been carried out with satisfactory results.

1521.18.3 Should a PUF system have inadequate adhesion to meet the design pressures, as set forth in Chapter 16 (High-Velocity Hurricane Zones), the roofing system shall be removed and replaced with a roofing system tested to adequate adhesion. An additional inspection shall be required once the roofing system has been replaced. A field adhesion test may be requested by the building official during the application or at the completion of the project to confirm adequate adhesion.

1521.18.4 The PUF system shall comply with Section 1521.

1521.18.5 All PUF systems shall be installed by licensed roofing contractors holding an applicator's certificate from

the manufacturer holding the product approval for the PUF system.

1521.19 Roof coverings or roofing components, such as tile, slate or similar, shall not be applied over an existing roofing system.

1521.20 Lightweight insulated concrete shall not be applied over an existing roofing system unless the existing roofing assembly is verified to be adequate to accept the new lightweight insulating concrete and is in compliance with the testing required herein.

1521.21 Existing ventilation. Ridge ventilation is recommended whenever possible to create airflow entering the soffit and exiting the ridge. Ridge ventilation shall not be installed without adequate soffit ventilation to draw outside air through the ridge void. When recovering, repairing or reroofing, the existing amount of attic ventilation shall not be reduced.

Exception: Attic spaces designed by a Florida-licensed engineer or registered architect to eliminate the attic venting.

SECTION 1522
HIGH-VELOCITY HURRICANE ZONES—ROOFTOP STRUCTURES AND COMPONENTS

1522.1 Rooftop structures. Rooftop structures shall be designed and constructed in accordance with the *Florida Building Code.*

1522.2 Rooftop mounted equipment. All rooftop equipment and supports shall be secured to the structure in compliance with the loading requirements of Chapter 16 (High-Velocity Hurricane Zones). The use of wood "sleepers" shall not be permitted.

Where equipment and appliances requiring access are installed on roofs or elevated structures at a height exceeding 16 feet (4877 mm), such access shall be provided by a permanent approved means of access, the extent of which shall be from grade or floor level to the equipment and appliances' level service space. Such access shall not require climbing over obstructions greater than 30 inches (762 mm) high or walking on roofs having a slope greater than 4 units vertical in 12 units horizontal (33-percent slope).

Permanent ladders installed to provide the required access shall comply with the following minimum design criteria:

1. The side railing shall extend above the parapet or roof edge not less than 30 inches (762 mm).
2. Ladders shall have rung spacing not to exceed 14 inches (356 mm) on center.
3. Ladders shall have a toe spacing not less than 6 inches (152 mm) deep.
4. There shall be a minimum of 18 inches (457 mm) between rails.
5. Rungs shall have a minimum 0.75-inch (19 mm) diameter and be capable of withstanding a 300-pound (136.1 kg) load.
6. Ladders over 30 feet (9144 mm) in height shall be provided with offset sections and landings capable of withstanding 100 pounds (488.2 kg/m^2) per square foot.
7. Ladders shall be protected against corrosion by approved means.

Catwalks installed to provide the required access shall be not less than 24 inches (610 mm) wide and shall have railings as required for service platforms.

Exception: This section shall not apply to Group R-3 occupancies. Minimum clearances below roof-mounted mechanical units shall be in accordance with Section 1509.7, *Florida Building Code, Building*.

1522.3 Machinery, piping, conduit, ductwork, signs and similar equipment may be mounted on roofs in compliance with the following:

1522.3.1 Permanently mounted rooftop equipment shall be installed to provide clearances, in accordance with Table 1522.3, to permit repairs, replacement and/or maintenance of the roofing system or any of its components.

TABLE 1522.3
ROOF MOUNTED EQUIPMENT HEIGHT REQUIREMENTS

WIDTH OF EQUIPMENT (in.)	HEIGHT OF LEGS (in.)
Up to 24	14
25 to 36	18
37 to 48	24
49 to 60	30
61 and wider	48

For SI: 1 inch = 25.4 mm.

1522.3.2 When reroofing, recovering, performing repair or roof maintenance, and where the roof top equipment is moved to properly execute such work, the minimum clearances of the said equipment support shall be in accordance with Table 1522.3.

1522.3.3 In buildings where the existing rooftop equipment, in the opinion of the building official, provides sufficient clearance to repair, recover, replace and/or maintain the roofing system or any of its components, such existing equipment need not comply with Table 1522.3.

1522.3.4 Electrical conduit, mechanical piping or any other service lines running on the roof shall be raised not less than 8 inches (203 mm) above the finished roof surface.

1522.3.5 Condensate lines shall not drain on the roofing system or any of its components. Condensate lines need not comply with the minimum clearance requirements.

SECTION 1523
HIGH-VELOCITY HURRICANE ZONES—TESTING

1523.1 Scope. This section defines the minimum testing requirements for substrates, roofing components, roofing systems and roofing assemblies. All roofing products shall be tested for physical properties, water-infiltration, uplift performance and fire resistance, as addressed within this code.

1523.1.1 Testing requirements for physical properties of all roofing products shall be as set forth in TAS 110.

1523.1.2 Testing requirements for fire resistance shall be in compliance with ASTM E 108 or UL 790.

1523.2 Application. Testing for substrates, roofing components, roofing systems and roofing assemblies shall comply with the provisions herein and those of *Florida Building Code, Building,* TAS and RAS listed in this code.

1523.3 Laboratory certification. All testing required by this code shall be performed by an approved testing laboratory.

1523.4 Margin of safety. A margin of safety of 2:1 shall be applied to all wind uplift resistance test results. All in-situ (on site) testing shall have an applied 1.45:1 margin of safety.

1523.5 Material labeling. All products shall be identified with the product approval number or logo; or the manufacturer's name or logo. ASTM standard roll goods shall be marked with a yellow line to identify the ASTM standard, or such other marking indicated in the Product Approval.

1523.5.1 All asphaltic shingles, tile products and metal roofing panels and clips shall be labeled on the underside with the *Florida Building Code, Building* insignia, or Product Approval number, or the wording "*Florida Building Code, Building* Product Approved," and manufacturer's initials or manufacturer's logo, or as specified in the manufacturer's Product Approval.

1523.6 Testing requirements.

1523.6.1 The certification agency, at its descretion, may carry out, observe or delegate the inspection and testing to an independent testing laboratory for any approved product. Should the manufacturer fail to meet the minimum requirements set forth in this code or specifically listed in the manufacturers product control approval, the certification agency shall have the authority to withdraw the approval until such time as the manufacturer complies with the approved physical properties. The certification agency shall have the authority, and shall charge the manufacturer for any cost incurred.

1523.6.2 Continuous roofing systems. All continuous roofing systems shall be tested in compliance with TAS 110 and TAS 114 in its entirety. All continuous roofing systems shall resist a minimum of 90 pounds per square foot (psf) (4309 Pa) tested wind uplift pressure resistance. Continuous roofing system testing requirements shall be as follows:

1523.6.2.1 Spray applied polyurethane foam. All spray applied polyurethane foam systems shall be tested in compliance to RAS 109 and TAS 110 and TAS 114.

1523.6.2.1.1 Physical properties testing for acrylic coatings used on spray applied polyurethane foam roofing assemblies shall be tested in compliance with ASTM D 6083 and federal specification TTC-555B, *Test Specification for Wind Driven Rain Infiltration Resistance.*

1523.6.3 Liquid applied roofing membranes systems. All liquid applied roofing membranes systems shall be tested in compliance with TAS 114, in addition to the physical properties testing requirements set forth in TAS 110, and fire resistance.

1523.6.3.1 For liquid applied acrylic roofing membrane assemblies, physical properties testing shall be in compliance with ASTM D 6083 and federal specification TTC-555B, Test Specification for Wind Driven Rain Infiltration Resistance.

1523.6.4 The building official may request that a quality control field uplift test be carried out on a continuous roofing system in compliance with test procedure TAS 124. Single-ply systems are not required to meet the deflection requirements established in the test protocol. The roofing system shall resist the design pressures as calculated in compliance with Chapter 16 (High-Velocity Hurricane Zones), and as established in TAS 124.

1523.6.4.1 Should a roofing system fail to meet a quality control field uplift test, the roofing contractor may propose to the building official an acceptable method of repair that is in compliance with the requirements of this code.

1523.6.5 Discontinuous roofing systems. All discontinuous roofing systems shall be tested in compliance with TAS 100 for wind-driven water infiltration resistance. Test specimens used for this test shall be constructed at the approved test facility. Testing requirements shall be as follows:

1523.6.5.1 Asphaltic shingle systems. All asphaltic shingle systems shall comply with the following requirements: TAS 100, TAS 107, ASTM D 3462 and ASTM D 3018. Asphaltic shingle systems shall have a quality control testing program by an approved independent listing agency having an unannounced follow-up visit. Follow-up test results shall be made available to the certification agency upon request.

1523.6.5.2 Clay and cement roof tiles. All roof tiles shall be tested in compliance with TAS 100. Physical properties testing for clay roof tiles shall be in compliance with ASTM D 1167. Physical properties testing for concrete roof tiles shall be in compliance with TAS 112. All approved roof tile manufacturers shall submit a quarterly TAS 112 Appendix A test report to the certification agency for review. All roof tiles shall resist a minimum wind uplift resistance as determined by Chapter 16 (High-Velocity Hurricane Zones) of this code and RAS 127. Clay and cement roof tile systems requirements are as follows:

1523.6.5.2.1 Underlayment. All underlayments used in discontinuous roof tile systems shall be tested in compliance with TAS 103 and TAS 104, unless otherwise specifically listed in the applicable RAS.

1523.6.5.2.2 Mortar or adhesive set roof tile systems. All mortar or adhesive set tile systems shall be tested for static uplift resistance in compliance with TAS 101, the results of which shall be listed in the system manufacturer's Product Approval.

1523.6.5.2.2.1 Additionally, roof tile system manufacturers may test for wind characteristics in compliance with TAS 108, provided the system is

determined to be air permeable by testing in compliance with TAS 116; and the tiles meet the size criteria set forth in TAS 108. The result from this testing shall be an aerodynamic multiplier (λ) which represents the system's wind characteristics and shall be listed in the system manufacturer's Product Approval.

1523.6.5.2.2.2 Systems which are tested for wind characteristics, in compliance with TAS 108 as specified above, shall have the results of the TAS 101 testing treated as attachment resistance moment (Mf), which is representative of the tile bond's resistance to overturning moment, and the tile's restoring moment due to gravity (Mg). Such systems shall use the system's aerodynamic multiplier (l) in conjunction with the system's attachment resistance moment (Mf) and restoring moment due to gravity (Mg), as determined from the TAS 101 static uplift testing. These results shall be used in conjunction with the attachment calculations outlined in RAS 127 as a moment-based system. Such calculations shall be submitted to the building official for review.

1523.6.5.2.2.3 Systems that are not tested in compliance with TAS 108 as specified above shall have their product control approval based on the system's uplift minimum characteristic resistance force *(F')*, as determined from TAS 101 static uplift testing. These results shall be used in conjunction with the attachment calculations outlined in RAS 127 as an uplift-based system. Such calculations shall be submitted to the building official for review.

1523.6.5.2.2.4 Testing in accordance with TAS 106 shall be considered a product application quality control test to determine the general adhesion properties of the system.

1523.6.5.2.3 Mechanically fastened, rigid roofing systems. All mechanically attached set tile systems shall be tested for static uplift resistance in compliance with TAS 102 or TAS 102(A), the results of which shall be listed in the system manufacturer's NOA.

1523.6.5.2.3.1 Additionally, roof tile system manufacturers may test for wind characteristics in compliance with TAS 108, provided the system is determined to be air permeable by testing in compliance with TAS 116; and the tiles meet the size criteria set forth in TAS 108. The result from this testing shall be an aerodynamic multiplier (k) which represents the system's wind characteristics and shall be listed in the system manufacturer's Product Approval.

1523.6.5.2.3.2 Systems which are tested for wind characteristics in compliance with TAS 108 as specified above shall have the results of the TAS 102 or TAS 102(A) testing treated as an attachment resistance moment (Mf) which is representative of the rigid component's attachment resistance to an overturning moment, and the tile's restoring moment due to gravity (Mg). Such systems shall use the system's aerodynamic multiplier (k), in conjunction with the system's attachment resistance moment (Mf) and restoring moment due to gravity (Mg), as determined from the TAS 102 or TAS 102(A) static uplift testing. These results shall be used in conjunction with the attachment calculations outlined in RAS 127 as a moment-based system. Such calculations shall be submitted to the building official for review.

1523.6.5.2.3.3 Systems that are not tested in compliance with TAS 108 as specified above shall have their product control approval based on the system's uplift minimum characteristic resistance force *(F')*, as determined from TAS 102 or TAS 102(A) static uplift testing. These results shall be used in conjunction with the attachment calculations outlined in RAS 127 as an uplift-based system. Such calculations shall be submitted to the building official for review.

1523.6.5.2.3.4 TAS 106 quality control field static uplift testing shall be considered a product application quality control test to determine the general uplift resistance properties of the system.

1523.6.5.2.4 Metal shingles/panels. All metal roofing shall be tested in compliance with TAS 100. All metal roofing shall resist a minimum wind uplift resistance as determined by Chapter 16 (High-Velocity Hurricane Zones) for a roof slope of 9.5 degrees (0.0166 rad) and a roof mean height of 15 feet (4.6 m). All metal roofing systems testing requirements shall be as follows:

1523.6.5.2.4.1 All metal roofing shall be test in compliance with requirements set forth in TAS 110 and TAS 125, and shall be tested for wind driven rain infiltration resistance in compliance with TAS 100.

1523.6.5.2.4.2 Rigid metal shingle systems may be tested in an identical manner to nail-on or batten tile systems as set forth in this code.

1523.6.5.2.5 Wood shingles or shakes. All wood shingles and shakes shall be tested, as a system, for wind driven rain infiltration resistance in compliance with TAS 100. The same specimens as tested in TAS 100 shall be tested for pull-through tear resistance, and such values shall be listed in the manufacturer's Product Approval.

1523.6.5.2.6 Fiber cement shingle or tile panels. All fiber cement shingles or tiles shall resist a minimum wind uplift resistance as determined by Chapter 16 (High-Velocity Hurricane Zones) for a roof slope of 9.5 degrees (0.0166 rad) and a roof mean height of 15 feet (4.6 m). All fiber cement shingle or tiles shall be tested in compliance with the following requirements. Wind driven water resistance in compliance with TAS

100, physical properties in compliance with TAS 110, TAS 135 and uplift resistance.

1523.6.5.2.6.1 Additionally, fiber cement tile system manufacturers may test for wind characteristics in compliance with TAS 108, provided the system is determined to be air permeable by testing in compliance with TAS 116 and the tiles meet the size criteria set forth in TAS 108. The result from this testing shall be an aerodynamic multiplier (k) which represents the system's wind characteristics and shall be listed in the system manufacturer's Product Approval.

1523.6.5.2.6.2 Systems which are tested for wind characteristics in compliance with TAS 108 as specified above shall have the results of the TAS 102 or TAS 102(A) testing treated as an attachment resistance moment (Mf) which is representative of the rigid component's attachment resistance to an overturning moment, and the tile's restoring moment due to gravity (Mg). Such systems shall use the system's aerodynamic multiplier (λ), in conjunction with the system's attachment resistance moment (Mf) and restoring moment due to gravity (Mg), as determined from the TAS 102 or TAS 102(A) static uplift testing. These results shall be used in conjunction with the attachment calculations outlined in RAS 127 as a moment-based system. Such calculations shall be submitted to the building official for review.

1523.6.5.2.6.3 Systems that are not tested in compliance with TAS 108 as specified above shall have their product approval based on the system's uplift minimum characteristic resistance force (F'), as determined from TAS 102 or TAS 102(A) static uplift testing. These results shall be used in conjunction with the attachment calculations outlined in RAS 115 as an uplift-based system. Such calculations shall be submitted to the building official for review.

1523.6.5.2.6.4 TAS 106 quality control field static uplift testing shall be considered a product application quality control test to determine the general uplift resistance properties of the system.

1523.6.5.2.7 Quarry roof slate. All quarry roof slate shall be tested in compliance with TAS 100 and TAS 110.

1523.6.5.2.8 Roof board insulation. All roof board insulation shall be tested for physical properties as set forth in Section 7 of TAS 110.

1523.6.5.2.9 Insulation fasteners, membrane fasteners and stress plates. All insulation fasteners, membrane fasteners and stress plates shall be tested in compliance with RAS 117 Appendices A, B and C, and TAS 110 and TAS 114, Appendix E, Section 3, (DIN 50018), for corrosion resistance.

1523.6.5.2.10 Roofing nails and tin-caps. All roofing nails and tin-caps shall be tested for corrosion resistance in compliance with TAS 114, Appendix E, Section 2 (ASTM G 85).

1523.6.5.2.11 Roof tile nails or fasteners. All roof tile nails or fasteners, except those made of copper, monel, aluminum or stainless steel, shall be tested for corrosion in compliance with TAS 114, Appendix E, Section 2 (ASTM G 85), for salt spray for 1000 hr.

1523.6.5.2.11.1 Tile fasteners used in coastal building zones, as defined in Chapter 16 (High-Velocity Hurricane Zone), shall be copper, monel, aluminum or stainless steel.

1523.6.5.2.12 Roofing adhesives, mastics and coatings. All roofing adhesives, mastics and coatings shall be tested in compliance with TAS 110 and TAS 121.

1523.6.5.2.12.1 All roofing adhesives, mastics and coatings shall have a quality control testing program by an approved independent listing agency having unannounced follow-up visits.

1523.6.5.2.12.2 Acrylic roof coatings shall be tested for physical properties in compliance with ASTM D 6083.

1523.6.5.2.13 Ridge vents of metal, plastic or composition material. All ridge vents shall be tested in compliance with TAS 100(A) for for wind driven water infiltration. All ridge ventilators shall be restricted to roof mean height as tested in compliance with TAS 100(A), and shall be listed in the system manufacturer's Product Approval.

1523.6.5.2.13.1 All plastic ridge ventilators shall be tested for physical properties as set forth in TAS 110 and Chapter 26 of this code.

1523.6.5.2.13.2 All plastic ridge ventilator manufacturers shall have an unannounced follow-up quality control program from an approved listing agency. Follow-up test results shall be made available to the certification agency upon request.

1523.6.5.2.14 Edge metal, flashings, and coping. All edge metal, flashing and copings, not specifically described in RAS 111, shall be tested in complianced with TAS 110, TAS 111(A), TAS 111(B) or TAS 111(C), respectively.

1523.6.5.2.15 Roof tile pre-mixed bagged mortar. All premixed roof tile mortar shall comply with the requirements set forth in TAS 110 and TAS 123, and shall have a quality control testing program by an approved independent listing agency having unannounced follow-up visits. Follow-up test results shall be made available to the certification agency upon request.

1523.6.5.2.16 Roof tile adhesive used in repair or supplemental tile attachment. All roof tile adhesive used in repair or supplemental tile attachment shall comply with the requirements set forth in TAS 110 and TAS 123(A).

1523.6.5.2.17 Roof tile adhesive used in adhesive set tiles systems. All roof tile adhesive used in adhesive set tile systems shall comply with the requirements set forth in TAS 110 and TAS 123. Physical properties shall be as follows:

1523.6.5.2.17.1 Tested for compressive strength in compliance with ASTM D 1621 with a minimum strength of 18 psi (121 kPa) parallel to rise, and 12 psi (82.7 kPa) perpendicular to rise.

1523.6.5.2.17.2 Tested for density in compliance with ASTM D 1622 with a minimum density of 1.6 lb/ft^3 (25.6 kg/m^3).

1523.6.5.2.17.3 Tested for tensile strength in compliance with ASTM D 1623 with a minimum requirement of 28 psi (193 kPa) parallel to rise.

1523.6.5.2.17.4 Tested for dimensional stability taken from a free rise sample specimen. Tested in compliance with ASTM D 2126 with a maximum volume change of +0.07 percent volume change at -40°F (-40°C) for two weeks; and +6.0 percent volume change at 158°F (70°C) and 100 percent RH for two weeks.

1523.6.5.2.17.5 Tested in compliance with ASTM D 2856 from a free rise sample specimen with a minimum requirement for 85 percent.

1523.6.5.2.17.6 Tested for water absorption in compliance with ASTM D 2842 with a maximum requirement of 10 percent.

1523.6.5.2.17.7 Tested in compliance with ASTM E 96 for moisture vapor transmission for a maximum of 3.1 perms.

SECTION 1524
HIGH-VELOCITY HURRICANE ZONES—REQUIRED OWNERS NOTIFICATION FOR ROOFING CONSIDERATIONS

1524.1 Scope. As it pertains to this section, it is the responsibility of the roofing contractor to provide the owner with the required roofing permit, and to explain to the owner the content of this section. The provisions of Chapter 15 of the *Florida Building Code, Building* govern the minimum requirements and standards of the industry for roofing system installations. Additionally, the following items should be addressed as part of the agreement between the owner and the contractor. The owner's initial in the designated space indicates that the item has been explained.

1. **Aesthetics-workmanship:** The workmanship provisions of Chapter 15 (High-Velocity Hurricane Zone) are for the purpose of providing that the roofing system meets the wind resistance and water intrusion performance standards. Aesthetics (appearance) are not a consideration with respect to workmanship provisions. Aesthetic issues such as color or architectural appearance, that are not part of a zoning code, should be addressed as part of the agreement between the owner and the contractor.
2. **Renailing wood decks:** When replacing roofing, the existing wood roof deck may have to be renailed in accordance with the current provisions of Chapter 16 (High-Velocity Hurricane Zones) of the *Florida Building Code, Building*. (The roof deck is usually concealed prior to removing the existing roof system.)
3. **Common roofs:** Common roofs are those which have no visible delineation between neighboring units (i.e., townhouses, condominiums, etc.). In buildings with common roofs, the roofing contractor and/or owner should notify the occupants of adjacent units of roofing work to be performed.
4. **Exposed ceilings:** Exposed, open beam ceilings are where the underside of the roof decking can be viewed from below. The owner may wish to maintain the architectural appearance; therefore, roofing nail penetrations of the underside of the decking may not be acceptable. The owner provides the option of maintaining this appearance.
5. **Ponding water:** The current roof system and/or deck of the building may not drain well and may cause water to pond (accumulate) in low-lying areas of the roof. Ponding can be an indication of structural distress and may require the review of a professional structural engineer. Ponding may shorten the life expectancy and performance of the new roofing system. Ponding conditions may not be evident until the original roofing system is removed. Ponding conditions should be corrected.
6. **Overflow scuppers (wall outlets):** It is required that rainwater flow off so that the roof is not overloaded from a buildup of water. Perimeter/edge walls or other roof extensions may block this discharge if overflow scuppers (wall outlets) are not provided. It may be necessary to install overflow scuppers in accordance with the requirements of: Chapter 15 and 16 herein and the *Florida Building Code, Plumbing.*
7. **Ventilation:** Most roof structures should have some ability to vent natural airflow through the interior of the structural assembly (the building itself). The existing amount of attic ventilation shall not be reduced.

Exception: Attic spaces, designed by a Florida-licensed engineer or registered architect to eliminate the attic venting, venting shall not be required.

Owner's/Agent's Signature _____ Date _____ Contractor's Signature _____

SECTION 1525
HIGH-VELOCITY HURRICANE ZONES UNIFORM PERMIT APPLICATION

Florida Building Code Edition 2004
High-Velocity Hurricane Zone Uniform Permit Application Form.

INSTRUCTION PAGE

COMPLETE THE NECESSARY SECTIONS OF THE UNIFORM ROOFING PERMIT APPLICATION FORM AND ATTACH THE REQUIRED DOCUMENTS AS NOTED BELOW:

Roof System	Required Sections of the Permit Application Form	Attachments Required See List Below
Low Slope Application	A,B,C	1,2,3,4,5,6,7
Prescriptive BUR-RAS 150	A,B,C	4,5,6,7
Asphaltic Shingles	A,B,D	1,2,4,5,6,7
Concrete or Clay Tile	A,B,D,E	1,2,3,4,5,6,7
Metal Roofs	A,B,D	1,2,3,4,5,6,7
Wood Shingles and Shakes	A,B,D	1,2,4,5,6,7
Other	As Applicable	1,2,3,4,5,6,7

ATTACHMENTS REQUIRED:

1.	Fire Directory Listing Page
2.	From Product Approval: Front Page Specific System Description Specific System Limitations General Limitations Applicable Detail Drawings
3.	Design Calculations per Chapter 16, or If Applicable, RAS 127 or RAS 128
4.	Other Component of Product Approval
5.	Municipal Permit Application
6.	Owners Notification for Roofing Considerations (Reroofing Only)
7.	Any Required Roof Testing/Calculation Documentation

Florida Building Code Edition 2004

High-Velocity Hurricane Zone Uniform Permit Application Form.

Section A (General Information)

Master Permit No._____ Process No. _____

Contractor's Name _____

Job Address_____

ROOF CATEGORY

☐ Low Slope ☐ Mechanically Fastened Tile ☐ Mortar/Adhesive Set Tile

☐ Asphaltic Shingles ☐ Metal Panel/Shingles ☐ Wood Shingles/Shakes

☐ Prescriptive BUR-RAS 150

ROOF TYPE

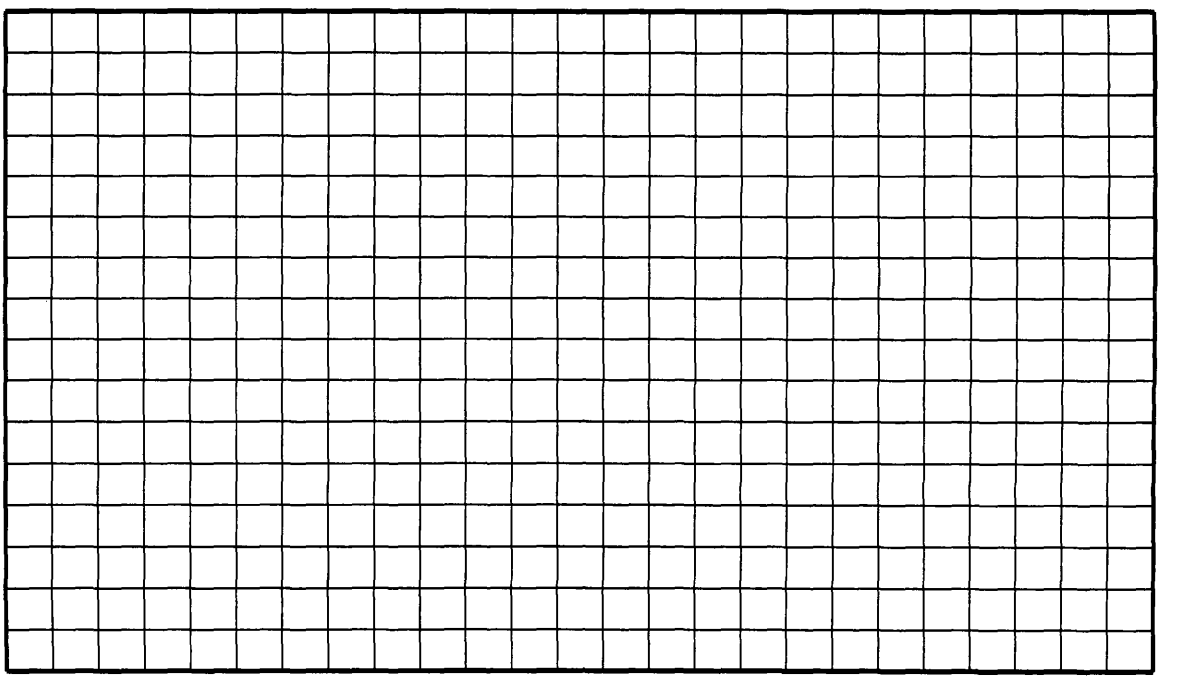
☐ New Roof ☐ Reroofing ☐ Recovering ☐ Repair ☐ Maintenance

ROOF SYSTEM INFORMATION

Low Slope Roof Area (SF) Steep Sloped Roof Area (SF) Total (SF)

Section B (Roof Plan)

Sketch Roof Plan: Illustrate all levels and sections, roof drains, scuppers, overflow scuppers and overflow drains. Include dimensions of sections and levels, clearly identify dimensions of elevated pressure zones and location of parapets.



Florida Building Code Edition 2004

High-Velocity Hurricane Zone Uniform Permit Application Form.

Section C (Low Slope Application)

Fill in specific roof assembly components and identify manufacturer (If a component is not used, identify as "NA")

System Manufacturer:_____

Product Approval No.:_____

Design Wind Pressures, From RAS 128 or Calculations:

Pmax1:_____ **Pmax2:**_____ **Pmax3:**_____

Max. Design Pressure, from the specific Product Approval system:_____

Deck:

Type:_____

Gauge/Thickness:_____

Slope:_____

Anchor/Base Sheet & No. of Ply(s):_____

Anchor/Base Sheet Fastener/Bonding Material:

_____

Insulation Base Layer: _____

Base Insulation Size and Thickness: _____

Base Insulation Fastener/Bonding Material:

_____

Top Insulation Layer: _____

Top Insulation Size and Thickness: _____

Top Insulation Fastener/Bonding Material:

_____

Base Sheet(s) & No. of Ply(s): _____

Base Sheet Fastener/Bonding Material:

_____

Ply Sheet(s) & No. of Ply(s): _____

Ply Sheet Fastener/Bonding Material:

_____

Top Ply: _____

Top Ply Fastener/Bonding Material:

_____

Surfacing: _____

Fastener Spacing for Anchor/Base Sheet Attachment:

Field: ____" oc @ Lap, # Rows ____ @ ____" oc

Perimeter: ____" oc @ Lap, # Rows ___ @ ____" oc

Corner: ____" oc @ Lap, # Rows ____ @ ____" oc

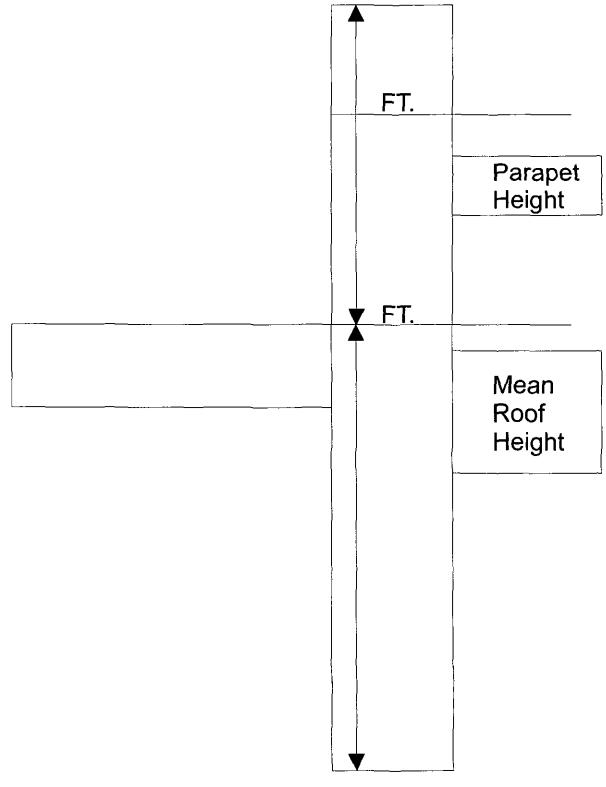
Number of Fasteners Per Insulation Board:

Field _____ **Perimeter** _____ **Corner** _____

Illustrate Components Noted and Details as Applicable:

Woodblocking, Gutter, Edge Termination, Stripping, Flashing, Continuous Cleat, Cant Strip, Base Flashing, Counter-Flashing, Coping, Etc.

Indicate: Mean Roof Height, Parapet Height, Height of Base Flashing, Component Material, Material Thickness, Fastener Type, Fastener Spacing or Submit



Florida Building Code Edition 2004

High-Velocity Hurricane Zone Uniform Permit Application Form.

Section D (Steep Sloped Roof System)

Roof System Manufacturer:
_____

Notice of Acceptance Number:
_____

Minimum Design Wind Pressures, If Applicable (From RAS 127 or Calculations):
P1: _____ **P2:** _____ **P3:** _____

Maximum Design Pressure (From the Product Approval Specific System):
_____

Steep Sloped Roof System Description

Roof Slope: _____: 12

Ridge Ventilation? _____

Mean Roof Height: _____

Deck Type:

Type Underlayment:

Insulation:

Fire Barrier:

Fastener Type & Spacing:

Adhesive Type:

Type Cap Sheet:

Roof Covering:

Type & Size Drip Edge:

Florida Building Code Edition 2004

High-Velocity Hurricane Zone Uniform Permit Application Form.

Section E (Tile Calculations)

For Moment based tile systems, choose either Method 1 or 2. Compare the values for M_r with the values from M_f. If the M_f values are greater than or equal to the M_r values, for each area of the roof, then the tile attachment method is acceptable.

Method 1 "Moment Based Tile Calculations Per RAS 127"

(P_1: _____ × λ _____ =_____) - Mg: _____ = M_{r1} _____ Product Approval M_f _____

(P_2: _____ × λ _____ =_____) - Mg: _____ = M_{r2} _____ Product Approval M_f _____

(P_3: _____ × λ _____ =_____) - Mg: _____ = M_{r3} _____ Product Approval M_f _____

Method 2 "Simplified Tile Calculations Per Table Below"

Required Moment of Resistance (Mr) From Table Below _____ Product Approval M_f _____

M_r required Moment Resistance*					
Mean Roof Height → Roof Slope ↓	**15'**	**20'**	**25'**	**30'**	**40'**
2:12	**34.4**	**36.5**	**38.2**	**39.7**	**42.2**
3:12	**32.2**	**34.4**	**36.0**	**37.4**	**39.8**
4:12	**30.4**	**32.2**	**33.8**	**35.1**	**37.3**
5:12	**28.4**	**30.1**	**31.6**	**32.8**	**34.9**
6:12	**26.4**	**28.0**	**29.4**	**30.5**	**32.4**
7:12	**24.4**	**25.9**	**27.1**	**28.2**	**30.0**

*Must be used in conjunction with a list of moment based tile systems endorsed by the Broward County Board of Rules and Appeals.

For Uplift based tile systems use Method 3. Compared the values for F' with the values for Fr. If the F' values are greater than or equal to the Fr values, for each area of the roof, then the tile attachment method is acceptable.

Method 3 "Moment Based Tile Calculations Per RAS 127"

(P_1: _____ × L _____ =_____ × w: = _____) - W: _____ × cos θ _____ = F_{r1} _____ Product Approval F' _____

(P_2: _____ × L _____ =_____ × w: = _____) - W: _____ × cos θ _____ = F_{r2} _____ Product Approval F' _____

(P_3: _____ × L _____ =_____ × w: = _____) - W: _____ × cos θ _____ = F_{r3} _____ Product Approval F' _____

Where to Obtain Information		
Description	**Symbol**	**Where to find**
Design Pressure	P1 or P2 or P3	RAS 127 Table 1 or by an engineering analysis prepared by PE based on ASCE 7
Mean Roof Height	H	Job Site
Roof Slope	θ	Job Site
Aerodynamic Multiplier	λ	Product Approval
Restoring Moment due to Gravity	M_g	Product Approval
Attachment Resistance	M_f	Product Approval
Required Moment Resistance	M_g	Calculated
Minimum Attachment Resistance	F'	Product Approval
Required Uplift Resistance	Fr	Calculated
Average Tile Weight	W	Product Approval
Tile Dimensions	L = length W = width	Product Approval
All calculations must be submitted to the building official at the time of permit application.		

CHAPTER 16
STRUCTURAL DESIGN

SECTION 1601
GENERAL

1601.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof regulated by this code.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 1612 through 1626.

SECTION 1602
DEFINITIONS AND NOTATIONS

1602.1 Definitions. The following words and terms shall, for the purposes of this chapter, have the meanings shown herein.

ALLOWABLE STRESS DESIGN. A method of proportioning structural members, such that elastically computed stresses produced in the members by nominal loads do not exceed specified allowable stresses (also called "working stress design").

BALCONY, EXTERIOR. An exterior floor projecting from and supported by a structure without additional independent supports.

BASE SHEAR. Total design lateral force or shear at the base.

DEAD LOADS. The weight of materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding and other similarly incorporated architectural and structural items, and the weight of fixed service equipment, such as cranes, plumbing stacks and risers, electrical feeders, heating, ventilating and air-conditioning systems and fire sprinkler systems.

DECK. An exterior floor supported on at least two opposing sides by an adjacent structure, and/or posts, piers or other independent supports.

DESIGN STRENGTH. The product of the nominal strength and a resistance factor (or strength reduction factor).

DIAPHRAGM. A horizontal or sloped system acting to transmit lateral forces to the vertical-resisting elements. When the term "diaphragm" is used, it shall include horizontal bracing systems.

Diaphragm, blocked. In light-frame construction, a diaphragm in which all sheathing edges not occurring on a framing member are supported on and fastened to blocking.

Diaphragm boundary. In light-frame construction, a location where shear is transferred into or out of the diaphragm sheathing. Transfer is either to a boundary element or to another force-resisting element.

Diaphragm chord. A diaphragm boundary element perpendicular to the applied load that is assumed to take axial stresses due to the diaphragm moment.

Diaphragm flexible. A diaphragm is flexible for the purpose of distribution of story shear and torsional moment where so indicated in Section 12.3.1 of ASCE 7, as modified in Section 1613.6.1.

Diaphragm, rigid. A diaphragm is rigid for the purpose of distribution of story shear and torsional moment when the lateral deformation of the diaphragm is less than or equal to two times the average story drift.

DURATION OF LOAD. The period of continuous application of a given load, or the aggregate of periods of intermittent applications of the same load.

ESSENTIAL FACILITIES. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.

FABRIC PARTITION. A partition consisting of a finished surface made of fabric, without a continuous rigid backing, that is directly attached to a framing system in which the vertical framing members are spaced greater than 4 feet (1219 mm) on center.

FACTORED LOAD. The product of a nominal load and a load factor.

GUARD. See Section 1002.1.

IMPACT LOAD. The load resulting from moving machinery, elevators, craneways, vehicles and other similar forces and kinetic loads, pressure and possible surcharge from fixed or moving loads.

LIMIT STATE. A condition beyond which a structure or member becomes unfit for service and is judged to be no longer useful for its intended function (serviceability limit state) or to be unsafe (strength limit state).

LIVE LOADS. Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

LIVE LOADS (ROOF). Those loads produced (1) during maintenance by workers, equipment and materials; and (2) during the life of the structure by movable objects such as planters and by people.

LOAD AND RESISTANCE FACTOR DESIGN (LRFD). A method of proportioning structural members and their connections using load and resistance factors such that no applicable limit state is reached when the structure is subjected to appropriate load combinations. The term "LRFD" is used in the design of steel and wood structures.

LOAD EFFECTS. Forces and deformations produced in structural members by the applied loads.

LOAD FACTOR. A factor that accounts for deviations of the actual load from the nominal load, for uncertainties in the analysis that transforms the load into a load effect, and for the prob-

ability that more than one extreme load will occur simultaneously.

LOADS. Forces or other actions that result from the weight of building materials, occupants and their possessions, environmental effects, differential movement and restrained dimensional changes. Permanent loads are those loads in which variations over time are rare or of small magnitude, such as dead loads. All other loads are variable loads (see also "Nominal loads").

NOMINAL LOADS. The magnitudes of the loads specified in this chapter (dead, live, soil, wind, snow, rain, flood and earthquake).

OCCUPANCY CATEGORY. A category used to determine structural requirements based on occupancy.

OTHER STRUCTURES. Structures, other than buildings, for which loads are specified in this chapter.

PANEL (PART OF A STRUCTURE). The section of a floor, wall or roof comprised between the supporting frame of two adjacent rows of columns and girders or column bands of floor or roof construction.

PRODUCTION GREENHOUSE. Greenhouses that are occupied for growing plants on a product or research basis without public access.

RESISTANCE FACTOR. A factor that accounts for deviations of the actual strength from the nominal strength and the manner and consequences of failure (also called "strength reduction factor").

STRENGTH, NOMINAL. The capacity of a structure or member to resist the effects of loads, as determined by computations using specified material strengths and dimensions and equations derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models, allowing for modeling effects and differences between laboratory and field conditions.

STRENGTH, REQUIRED. Strength of a member, cross section or connection required to resist factored loads or related internal moments and forces in such combinations as stipulated by these provisions.

STRENGTH DESIGN. A method of proportioning structural members such that the computed forces produced in the members by factored loads do not exceed the member design strength [also called "load and resistance factor design" (LRFD)]. The term "strength design" is used in the design of concrete and masonry structural elements.

VEHICLE BARRIER SYSTEM. A system of building components near open sides of a garage floor or ramp or building walls that act as restraints for vehicles.

NOTATIONS.

D = Dead load.

F = Load due to fluids with well-defined pressures and maximum heights.

F_a = Flood load.

H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.

L = Live load, except roof live load, including any permitted live load reduction.

L_r = Roof live load including any permitted live load reduction.

R = Rain load.

T = Self-straining force arising from contraction or expansion resulting from temperature change, shrinkage, moisture change, creep in component materials, movement due to differential settlement or combinations thereof.

W = Load due to wind pressure.

SECTION 1603
CONSTRUCTION DOCUMENTS

1603.1 General. Construction documents shall show the size, section and relative locations of structural members with floor levels, column centers and offsets fully dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.8 shall be clearly indicated on the construction documents for parts of the building or structure.

Exception: Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof live loads.
2. Basic wind speed (3-second gust), miles per hour (mph) (m/s) and wind exposure.

1603.1.1 Floor live load. The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.9 shall be indicated for each type of live load used in the design.

1603.1.2 Roof live load. The roof live load used in the design shall be indicated for roof areas (Section 1607.11).

1603.1.3 Roof snow load. Reserved.

1603.1.4 Wind design data. The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral-force-resisting system of the building:

1. Basic wind speed (3-second gust), miles per hour (m/s).
2. Wind importance factor, I_W, and building classification from Table 1604.5 or Table 6-1, ASCE 7 and building classification in Table 1-1, ASCE 7.
3. Wind exposure. Where more than one wind exposure is utilized, the wind exposure and applicable wind direction shall be indicated.
4. The applicable enclosure classifications and, if designing with ASCE 7, internal pressure coefficient.
5. Components and cladding. The design wind pressures in terms of psf (kN/m^2) to be used for the selection of exterior components and cladding materials

not specifically designed by the registered design professional.

1603.1.5 Earthquake design data. Reserved.

1603.1.6 Flood design data. Reserved.

1603.1.7 Special loads. Special loads that are applicable to the design of the building, structure or portions thereof shall be indicated along with the specified section of this code that addresses the special loading condition.

1603.1.8 Systems and components requiring special inspections for seismic resistance. Reserved.

1603.2 Restrictions on loading. It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than is permitted by these requirements.

1603.3 Live loads posted. Where the live loads for which each floor or portion thereof of a commercial or industrial building is or has been designed to exceed 50 psf (2.40 kN/m^2), such design live loads shall be conspicuously posted by the owner in that part of each story in which they apply, using durable signs. It shall be unlawful to remove or deface such notices.

1603.4 Occupancy permits for changed loads. Occupancy permits for buildings hereafter erected shall not be issued until the floor load signs, required by Section 1603.3, have been installed.

SECTION 1604
GENERAL DESIGN REQUIREMENTS

1604.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters.

1604.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections and lateral drift.

1604.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or that permitted by Table 1604.3.

1604.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI-NAS, AISI-General, AISI-Truss, ASCE 3, ASCE 8, SJI JG-1.1, SJI K-1.1 or SJI LH/DLH-1.1, as applicable.

1604.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by ACI 530/ASCE 5/TMS 402.

1604.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM1.

1604.3.6 Limits. Deflection of structural members over span, l, shall not exceed that permitted by Table 1604.3.

TABLE 1604.3
DEFLECTION LIMITS[a, b, c, h, i, j]

CONSTRUCTION	L	S or W^l	$D + L^{d,g}$
Roof members:[c]			
Supporting plaster ceiling	$l/360$	$l/360$	$l/240$
Supporting nonplaster ceiling	$l/240$	$l/240$	$l/180$
Not supporting ceiling	$l/180$	$l/180$	$l/120$
Members supporting screen surface	----	-----	$l/60$
Floor members	$l/360$	—	$l/240$
Exterior walls and interior partitions:			
With brittle finishes	—	$l/240$	—
With flexible finishes	—	$l/120$	—
Farm buildings	—	—	$l/180$
Greenhouses	—	—	$l/120$

For SI: 1 foot = 304.8 mm.

a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed $l/60$. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed $l/150$. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed $l/90$. For roofs, this exception only applies when the metal sheets have no roof covering.

b. Interior partitions not exceeding 6 feet in height and flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.13.

c. See Section 2403 for glass supports.

d. For wood structural members having a moisture content of less than 16 percent at time of installation and used under dry conditions, the deflection resulting from $L + 0.5D$ is permitted to be substituted for the deflection resulting from $L + D$.

e. The above deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to assure adequate drainage shall be investigated for ponding. See Section 1611 for rain and ponding requirements and Section 1503.4 for roof drainage requirements.

f. The wind load is permitted to be taken as 0.7 times the "component and cladding" loads for the purpose of determining deflection limits herein.

g. For steel structural members, the dead load shall be taken as zero.

h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers, not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed l/60. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed l/120.

i. For cantilever members, l shall be taken as twice the length of the cantilever.

j. Screen surfaces shall be permitted to include a maximum of 25% solid flexible finishes.

1604.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the added eccentricities expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral-force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral-force-resisting system are permitted to be incorporated into buildings provided their effect on the action of the system is considered and provided for in the design. Except where diaphragms are flexible, or are permitted to be analyzed as flexible, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral-force-resisting system.

Every structure shall be designed to resist the overturning effects caused by the lateral forces specified in this chapter. See Section 1609 for wind loads, and Section 1610 for lateral soil loads.

1604.5 Occupancy category. Buildings shall be assigned an occupancy category in accordance with Table 1604.5.

1604.5.1 Multiple occupancies. Where a structure is occupied by two or more occupancies not included in the same occupancy category, the structure shall be assigned the classification of the highest occupancy category corresponding to the various occupancies. Where structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a structure provides required access to, required egress from or shares life safety components with another portion having a higher occupancy category, both portions shall be assigned to the higher occupancy category.

1604.6 In-situ load tests. The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1713.

1604.7 Preconstruction load tests. Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the applicable material design standards listed in Chapter 35, or alternative test procedures in accordance with Section 1711, shall be load tested in accordance with Section 1714.

1604.8 Anchorage.

1604.8.1 General. Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

1604.8.2 Concrete and masonry walls. Concrete and masonry walls shall be anchored to floors, roofs and other structural elements that provide lateral support for the wall. Such anchorage shall provide a positive direct connection capable of resisting the horizontal forces specified in this chapter but not less than a minimum strength design horizontal force of 280 plf (4.10 kN/m) of wall, unless the lateral force has otherwise been calculated by the Engineer of Record. Walls shall be designed to resist bending between anchors where the anchor spacing exceeds 4 feet (1219 mm). Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609 for wind design requirements.

1604.8.3 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. For decks with cantilevered framing members, connections to exterior walls or other framing members shall be designed and constructed to resist uplift resulting from the full live load specified in Table 1607.1 acting on the cantilevered portion of the deck.

1604.9 Counteracting structural actions. Structural members, systems, components and cladding shall be designed to resist forces due to wind, with consideration of overturning, sliding, and uplift. Continuous load paths shall be provided for transmitting these forces to the foundation. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1604.10 Wind and seismic detailing. Reserved.

SECTION 1605
LOAD COMBINATIONS

1605.1 General. Buildings and other structures and portions thereof shall be designed to resist the load combinations specified in Section 1605.2 or 1605.3 and Chapters 18 through 23. Applicable loads shall be considered, including wind, in accordance with the specified load combinations. Each load combination shall also be investigated with one or more of the variable loads set to zero.

1605.2 Load combinations using strength design or load and resistance factor design.

1605.2.1 Basic load combinations. Where strength design or load and resistance factor design is used, structures and portions thereof shall resist the most critical effects from the following combinations of factored loads:

$1.4(D+F)$ **(Equation 16-1)**

$1.2(D+F+T)+1.6(L+H)+0.5(L_r \text{ or } R)$ **(Equation 16-2)**

TABLE 1604.5
OCCUPANCY CATEGORY OF BUILDINGS AND OTHER STRUCTURES

OCCUPANCY CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities. • Screen enclosures
II	Buildings and other structures except those listed in Occupancy Categories I, III and IV
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Covered structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures with elementary school, secondary school or day care facilities with an occupant load greater than 250. • Buildings and other structures with an occupant load greater than 500 for colleges or adult education facilities. • Health care facilities with an occupant load of 50 or more resident patients, but not having surgery or emergency treatment facilities. • Jails and detention facilities. • Any other occupancy with an occupant load greater than 5,000. • Power-generating stations, water treatment for potable water, waste water treatment facilities and other public utility facilities not included in Occupancy Category IV. • Buildings and other structures not included in Occupancy Category IV containing sufficient quantities of toxic or explosive substances to be dangerous to the public if released.
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Hospitals and other health care facilities having surgery or emergency treatment facilities. • Fire, rescue and police stations and emergency vehicle garages. • Designated hurricane or other emergency shelters. • Designated emergency preparedness, communication, and operation centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Occupancy Category IV structures. • Structures containing highly toxic materials as defined by Section 307 where the quantity of the material exceeds the maximum allowable quantities of Table 307.1.(2). • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water treatment facilities required to maintain water pressure for fire suppression.

$1.2D + 1.6(L_r \text{ or } R) + (f_1 L \text{ or } 0.8W)$ **(Equation 16-3)**

$1.2D + 1.6W + f_1 L + 0.5(L_r \text{ or } R)$ **(Equation 16-4)**

$1.2D + f_1 L$ **(Equation 16-5)**

$0.9D + 1.6W + 1.6H$ **(Equation 16-6)**

$0.9D + 1.6H$ **(Equation 16-7)**

f_1 = 1 for floors in places of public assembly, for live loads in excess of 100 pounds per square foot (4.79 kN/m^2), and for parking garage live load, and

= 0.5 for other live loads

Exception: Where other factored load combinations are specifically required by the provisions of this code, such combinations shall take precedence.

1605.2.2 Other loads. Where F_a is to be considered in the design, the load combinations of Section 2.3.3 of ASCE 7 shall be used.

1605.3 Load combinations using allowable stress design.

1605.3.1 Basic load combinations. Where allowable stress design (working stress design), as permitted by this code, is used, structures and portions thereof shall resist the most critical effects resulting from the following combinations of loads:

$D + F$ **(Equation 16-8)**

$D + H + F + \text{L} + T$ **(Equation 16-9)**

$D + H + F + (L_r \text{ or } R)$ **(Equation 16-10)**

$D + H + F + 0.75(L + T) + 0.75\,(L_r \text{ or } R)$ **(Equation 16-11)**

$D + H + F + (W)$ **(Equation 16-12)**

$D + H + F + 0.75(W) + 0.75L + 0.75\,(L_r \text{ or } R)$ **(Equation 16-13)**

$0.6D + W + H$ **(Equation 16-14)**

$0.6D + H$ **(Equation 16-15)**

Exception: Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load.

1605.3.1.1 Load reduction.

1. It is permitted to multiply the combined effect of two or more variable loads by 0.75 and add the effect of dead load. The combined load used in design shall not be less than the sum of the effect of dead load and any of the variable loads.
2. Increases in allowable stress specified in the materials sections of this code or a referenced standard shall not be permitted to be used with load combinations of Sections 1605.3.1. Duration of load increase shall be permitted in accordance with Chapter 23.

   Exception: Increases in allowable stress shall be permitted in accordance with ACI 530/ASCE 5/TMS 402 provided the load reduction of Section 1605.3.1.1 Item 1 shall not be applied.
3. Simultaneous use of both one-third increase in allowable stress and the 25 percent reduction in combined loads shall not be permitted.

1605.3.1.2 Other loads. Where F_a is to be considered in design, the load combinations of Section 2.4.2 of ASCE 7 shall be used.

1605.3.2 Alternative basic load combinations. In lieu of the basic load combinations specified in Section 1605.3.1, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. When using these alternative basic load combinations that include wind loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. Where wind loads are calculated in accordance with Chapter 6 of ASCE 7, the coefficient ω in the following equations shall be taken as 1.3. For other wind loads, ω shall be taken as 1. When using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used.

$D + L + (L_r \text{ or } R)$ **(Equation 16-16)**

$D + L + (\omega W)$ **(Equation 16-17)**

Equation 16-18. Reserved.

$D + L + \omega W/2$ **(Equation 16-19)**

$D + L$ **(Equation 16-20)**

$0.9D$ **(Equation 16-21)**

Exception: Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load.

1605.3.2.1 Other loads. Where F, H or T are to be considered in the design, each applicable load shall be added to the combinations specified in Section 1605.3.2.

1605.4 Special seismic load combinations. Reserved.

1605.5 Heliports and helistops. Heliport and helistop landing areas shall be designed for the following loads, combined in accordance with Section 1605:

1. Dead load, D, plus the gross weight of the helicopter, Dh, plus snow load, S.
2. Dead load, D, plus two single concentrated impact loads, L, approximately 8 feet (2438 mm) apart applied anywhere on the landing area (representing the helicopter's two main landing gear, whether skid type or wheeled type), having a magnitude of 0.75 times the gross weight of the helicopter. Both loads acting together total one-and one half times the gross weight of the helicopter.

3. Dead load, D, plus a uniform live load, L, of 100 psf (4.79 kN/m^2).

   Exception: Landing areas designed for helicopters with gross weights not exceeding 3,000 pounds (13.34 kN) in accordance with Items 1 and 2 shall be permitted to be designed using a 40 psf (1.92 kN/m^2) uniform live load in Item 3, provided the landing area is identified with a 3,000 pound (13.34 kN) weight limitation. This 40 psf (1.92 kN/m^2) uniform live load shall not be reduced. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The landing area weight limitation shall be a minimum of 5 feet (1524 mm) in height.

SECTION 1606
DEAD LOADS

1606.1 General. Dead loads are those loads defined in Section 1602.1. Dead loads shall be considered permanent loads.

1606.2 Design dead load. For purposes of design, the actual weights of materials of construction and fixed service equipment shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

SECTION 1607
LIVE LOADS

1607.1 General. Live loads are those loads defined in Section 1602.1.

1607.2 Loads not specified. For occupancies or uses not designated in Table 1607.1, the live load shall be determined in accordance with a method approved by the building official.

1607.3 Uniform live loads. The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall in no case be less than the minimum uniformly distributed unit loads required by Table 1607.1.

1607.4 Concentrated loads. Floors and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607.3 or the concentrated load, in pounds (kilonewtons), given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area 2.5 feet by 2.5 feet [6.25 square feet (0.58 m^2)] and shall be located so as to produce the maximum load effects in the structural members.

1607.5 Partition loads. In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load exceeds 80 psf (3.83 kN/m^2). The partition load shall not be less than a uniformly distributed live load of 15 psf (0.74 kN/m^2).

1607.6 Truck and bus garages. Minimum live loads for garages having trucks or buses shall be as specified in Table 1607.6, but shall not be less than 50 psf (2.40 kN/m^2), unless other loads are specifically justified and approved by the building official. Actual loads shall be used where they are greater than the loads specified in the table.

TABLE 1607.6
UNIFORM AND CONCENTRATED LOADS

LOADING CLASS[a]	UNIFORM LOAD (pounds/linear foot of lane)	CONCENTRATED LOAD (pounds)[b]	
		For moment design	For shear design
H20-44 and HS20-44	640	18,000	26,000
H15-44 and HS15-44	480	13,500	19,500

For SI: 1 pound per linear foot = 0.01459 kN/m, 1 pound = 0.004448 kN, 1 ton = 8.90 kN.

a. An H loading class designates a two-axle truck with a semitrailer. An HS loading class designates a tractor truck with a semitrailer. The numbers following the letter classification indicate the gross weight in tons of the standard truck and the year the loadings were instituted.

b. See Section 1607.6.1 for the loading of multiple spans.

1607.6.1 Truck and bus garage live load application. The concentrated load and uniform load shall be uniformly distributed over a 10-foot (3048 mm) width on a line normal to the centerline of the lane placed within a 12-foot-wide (3658 mm) lane. The loads shall be placed within their individual lanes so as to produce the maximum stress in each structural member. Single spans shall be designed for the uniform load in Table 1607.6 and one simultaneous concentrated load positioned to produce the maximum effect. Multiple spans shall be designed for the uniform load in Table 1607.6 on the spans and two simultaneous concentrated loads in two spans positioned to produce the maximum negative moment effect. Multiple span design loads, for other effects, shall be the same as for single spans.

1607.7 Loads on handrails, guards, grab bars and vehicle barriers. Handrails, guards, grab bars as designed in Chapter 11 and vehicle barriers shall be designed and constructed to the structural loading conditions set forth in this section.

1607.7.1 Handrails and guards. Handrail assemblies and guards shall be designed to resist a load of 50 plf (0.73 kN/m) applied in any direction at the top and to transfer this load through the supports to the structure. Glass handrail assemblies and guards shall also comply with Section 2407.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607.7.1.1 shall be applied.
2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

1607.7.1.1 Concentrated load. Handrail assemblies and guards shall be able to resist a single concentrated load of 200 pounds (0.89 kN), applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropri-

TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
1. Apartments (see residential)	—	—
2. Access floor systems		
Office use	50	2,000
Computer use	100	2,000
3. Armories and drill rooms	150	—
4. Assembly areas and theaters		
Fixed seats (fastened to floor)	60	
Follow spot, projections and control rooms	50	—
Lobbies	100	
Movable seats	100	
Stages and platforms	125	
5. Balconies	100	
On one- and two-family residences only, and not exceeding 100 sq ft	60	—
6. Bowling alleys	75	—
7. Catwalks	40	300
8. Dance halls and ballrooms	100	—
9. Decks	Same as occupancy served[h]	—
10. Dining rooms and restaurants	100	—
11. Dwellings (see residential)	—	—
12. Cornices	60	—
13. Corridors, except as otherwise indicated	100	—
14. Elevator machine room grating (on area of 4 in^2)	—	300
15. Finish light floor plate construction (on area of 1 in^2)	—	200
	—	
16. Fire escapes	100	—
On single-family dwellings only	40	
17. Garages (passenger vehicles only)	40	Note a
Trucks and buses	See Section 1607.6	
18. Grandstands (see stadium and arena bleachers)	—	—
19. Gymnasiums, main floors and balconies	100	—
20. Handrails, guards and grab bars	See Section 1607.7	
21. Hospitals		
Corridors above first floor	80	1,000
Operating rooms, laboratories	60	1,000
Patient rooms	40	1,000
22. Hotels (see residential)	—	—

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
23. Libraries		
Corridors above first floor	80	1,000
Reading rooms	60	1,000
Stack rooms	150[b]	1,000
24. Manufacturing		
Heavy	250	3,000
Light	125	2,000
25. Marquees	75	—
26. Office buildings		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000
27. Penal institutions		
Cell blocks	40	—
Corridors	100	
28. Residential		
One- and two-family dwellings		
Uninhabitable attics without storage[i]	10	
Uninhabitable attics with limited storage[i, j, k]	20	
Habitable attics and sleeping areas	30	
All other areas except balconies and decks	40	—
Hotels and multiple-family dwellings		
Private rooms and corridors serving them	40	
Public rooms and corridors serving them	100	
29. Reviewing stands, grandstands and bleachers	Note c	
30. Roofs		
All roof surfaces subject to maintenance workers		300
Awnings and canopies		
Fabric construction supported by a lightweight rigid skeleton structure	5 nonreduceable	
All other construction	20	
Ordinary flat, pitched, and curved roofs	20	
Primary roof members, exposed to a work floor		
Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs:		
Over manufacturing, storage warehouses, and repair garages		2,000
		300
All other occupancies	Note l	Note l
Roofs used for other special purposes	60	
Roofs used for promenade purposes	100	
Roofs used for roof gardens or assembly purposes		

(continued)

TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
31. Schools		
Classrooms	40	1,000
Corridors above first floor	80	1,000
First-floor corridors	100	1,000
32. Scuttles, skylight ribs and accessible ceilings	—	200
33. Sidewalks, vehicular driveways and yards, subject to trucking	250d	8,000e
34. Skating rinks	100	—
35. Stadiums and arenas		
Bleachers	100c	—
Fixed seats (fastened to floor)	60c	
36. Stairs and exits		Note f
One- and two-family dwellings	40	
All other	100	
37. Storage warehouses (shall be designed for heavier loads if required for anticipated storage)		
Heavy	250	
Light	125	
38. Stores		
Retail		
First floor	100	1,000
Upper floors	75	1,000
Wholesale, all floors	125	1,000
39. Vehicle barriers	See Section 1607.7.3	
40. Walkways and elevated platforms (other than exitways)	60	—
41. Yards and terraces, pedestrians	100	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN, 1 pound per cubic foot = 16 kg/m^3

a. Floors in garages or portions of buildings used for the storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 1607.1 or the following concentrated loads: (1) for garages restricted to vehicles accommodating not more than nine passengers, 3,000 pounds acting on an area of 4.5 inches by 4.5 inches; (2) for mechanical parking structures without slab or deck which are used for storing passenger vehicles only, 2,250 pounds per wheel.

b. The loading applies to stack room floors that support nonmobile, double-faced library bookstacks, subject to the following limitations:
   1. The nominal bookstack unit height shall not exceed 90 inches;
   2. The nominal shelf depth shall not exceed 12 inches for each face; and
   3. Parallel rows of double-faced bookstacks shall be separated by aisles not less than 36 inches wide.

c. Design in accordance with the ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands.

d. Other uniform loads in accordance with an approved method which contains provisions for truck loadings shall also be considered where appropriate.

e. The concentrated wheel load shall be applied on an area of 20 square inches.

f. Minimum concentrated load on stair treads (on area of 4 square inches) is 300 pounds.

g. Reserved.

h. See Section 1604.8.3 for decks attached to exterior walls.

i. Attics without storage are those where the maximum clear height between the joist and rafter is less than 42 inches, or where there are not two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high by 2 feet wide, or greater, located within the plane of the truss. For attics without storage, this live load need not be assumed to act concurrently with any other live load requirements.

j. For attics with limited storage and constructed with trusses, this live load need be applied only to those portions of the bottom chord where there are two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high by 2 feet wide or greater, located within the plane of the truss. The rectangle shall fit between the top of the bottom chord and the bottom of any other truss member, provided that each of the following criteria is met:
   i. The attic area is accessible by a pull-down stairway or framed opening in accordance with Section 1209.2, and
   ii. The truss shall have a bottom chord pitch less than 2:12.
   iii. Bottom chords of trusses shall be designed for the greater of actual imposed dead load or 10 psf, uniformly distributed over the entire span.

k. Attic spaces served by a fixed stair shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.

l. Roofs used for other special purposes shall be designed for appropriate loads as approved by the building official.

ate structural elements of the building. This load need not be assumed to act concurrently with the loads specified in the preceding paragraph.

1607.7.1.2 Components. Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds (0.22 kN) on an area equal to 1 square foot (0.093 m^2), including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of Section 1607.7.1 or 1607.7.1.1.

1607.7.1.3 Stress increase. Where handrails and guards are designed in accordance with the provisions for allowable stress design (working stress design) exclusively for the loads specified in Section 1607.7.1, the allowable stress for the members and their attachments is permitted to be increased by one-third.

1607.7.2 Grab bars, shower seats and dressing room bench seats. Grab bars, shower seats and dressing room bench seat systems shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point.

1607.7.3 Vehicle barriers. Vehicle barrier systems for passenger cars shall be designed to resist a single load of 6,000 pounds (26.70 kN) applied horizontally in any direction to the barrier system and shall have anchorage or attachment capable of transmitting this load to the structure. For design of the system, the load shall be assumed to act at a minimum height of 1 foot, 6 inches (457 mm) above the floor or ramp surface on an area not to exceed 1 square foot (305 mm^2), and is not required to be assumed to act concurrently with any handrail or guard loadings specified in the preceding paragraphs of Section 1607.7.1. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provision for traffic railings.

1607.8 Impact loads. The live loads specified in Section 1607.3 include allowance for impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607.8.1 Elevators. Elevator loads shall be increased by 100 percent for impact and the structural supports shall be designed within the limits of deflection prescribed by ASME A17.1.

1607.8.2 Machinery. For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact: (1) elevator machinery, 100 percent; (2) light machinery, shaft- or motor-driven, 20 percent; (3) reciprocating machinery or power-driven units, 50 percent; (4) hangers for floors or balconies, 33 percent. Percentages shall be increased where specified by the manufacturer.

1607.9 Reduction in live loads. Except for roof uniform live loads, all other minimum uniformly distributed live loads, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.9.1 or 1607.9.2.

1607.9.1 General. Subject to the limitations of Sections 1607.9.1.1 through 1607.9.1.4, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m^2) or more are permitted to be designed for a reduced live load in accordance with the following equation:

$$L = L_o\left(0.25+\frac{15}{\sqrt{K_{LL}A_T}}\right) \qquad \textbf{(Equation 16-24)}$$

For SI: $L = L_o\left(0.25+\frac{4.57}{\sqrt{K_{LL}A_T}}\right)$

where:

L = Reduced design live load per square foot (meter) of area supported by the member.

L_o = Unreduced design live load per square foot (meter) of area supported by the member (see Table 1607.1).

K_{LL}= Live load element factor (see Table 1607.9.1).

A_T = Tributary area, in square feet (square meters).

L shall not be less than $0.50L_o$ for members supporting one floor and L shall not be less than $0.40L_o$ for members supporting two or more floors.

1607.9.1.1 Heavy live loads. Live loads that exceed 100 psf (4.79 kN/m^2) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than L as calculated in Section 1607.9.1.
2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

TABLE 1607.9.1
LIVE LOAD ELEMENT FACTOR, K_{LL}

ELEMENT	K_{LL}
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
All other members not identified above including: Edge beams with cantilever slabs Cantilever beams Two-way slabs Members without provisions for continuous shear transfer normal to their span	1

1607.9.1.2 Passenger vehicle garages. The live loads shall not be reduced in passenger vehicle garages except the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than L as calculated in Section 1607.9.1.

1607.9.1.3 Special occupancies. Live loads of 100 psf (4.79 kN/m^2) or less shall not be reduced in public assembly occupancies.

1607.9.1.4 Special structural elements. Live loads shall not be reduced for one-way slabs except as permitted in Section 1607.9.1.1. Live loads of 100 psf (4.79 kN/m^2) or less shall not be reduced for roof members except as specified in Section 1607.11.2.

1607.9.2 Alternate floor live load reduction. As an alternative to Section 1607.9.1, floor live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted in Group A occupancies.
2. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m^2) except that the design live load for members supporting two or more floors is permitted to be reduced by 20 percent.
3. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent.
4. For live loads not exceeding 100 psf (4.79 kN/m^2), the design live load for any structural member supporting 150 square feet (13.94 m^2) or more is permitted to be reduced in accordance with the following equation:

$$R = 0.08(A - 150) \qquad \textbf{(Equation 16-25)}$$

For SI: $R = 0.861\ (A - 13.94)$

Such reduction shall not exceed the smallest of:

1. 40 percent for horizontal members;

2. 60 percent for vertical members; or
3. R as determined by the following equation.

$R = 23.1\,(1 + D/L_o)$ **(Equation 16-26)**

where:

A = Area of floor supported by the member, square feet (m^2).

D = Dead load per square foot (m^2) of area supported.

L_o = Unreduced live load per square foot (m^2) of area supported.

R = Reduction in percent.

1607.10 Distribution of floor loads. Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest effect at each location under consideration. It shall be permitted to reduce floor live loads in accordance with Section 1607.9.

1607.11 Roof loads. The structural supports of roofs and marquees shall be designed to resist wind loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.11.1 Distribution of roof loads. Where uniform roof live loads are reduced to less than 20 psf (0.96 kN/m^2) in accordance with Section 1607.11.2.1 and are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the roof live loads on adjacent spans or on alternate spans, whichever produces the greatest effect. See Section 1607.11.2 for minimum roof live loads.

1607.11.2 Reduction in roof live loads. The minimum uniformly distributed roof live loads, L_o, in Table 1607.1 are permitted to be reduced according to the following provisions.

1607.11.2.1 Flat, pitched and curved roofs. Ordinary flat, pitched and curved roofs are permitted to be designed for a reduced roof live load as specified in the following equation or other controlling combinations of loads in Section 1605, whichever produces the greater load. In structures where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equation shall not be used unless approved by the building official. Greenhouses shall be designed for a minimum roof live load of 12 psf (0.58 kN/m^2).

$L_r = L_o R_1 R_2$ **(Equation 16-27)**

where: $12 \le L_r \le 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \le L_r \le 0.96$

L_r = Reduced live load per square foot (m^2) of horizontal projection in pounds per square foot (kN/m^2).

The reduction factors R_1 and R_2 shall be determined as follows:

$R_1 = 1$ for $A_t \le 200$ square feet (18.58 m^2) **(Equation 16-28)**

$R_1 = 1.2 - 0.001A_t$ for 200 square feet $< A_t <$ 600 square feet **(Equation 16-29)**

For SI: $1.2 - 0.011A_t$ for 18.58 square meters $< A_t <$ 55.74 square meters

$R_1 = 0.6$ for $A_t > 600$ square feet (55.74 m^2) **(Equation 16-30)**

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m^2) supported by any structural member, and

$R_2 = 1$ for $F \le 4$ **(Equation 16-31)**

$R_2 = 1.2 - 0.05F$ for $4 < F < 12$ **(Equation 16-32)**

$R_2 = 0.6$ for $F \ge 12$ **(Equation 16-33)**

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607.11.2.2 Special-purpose roofs. Roofs used for promenade purposes, roof gardens, assembly purposes or other special purposes shall be designed for a minimum live load as required in Table 1607.1. Such roof live loads are permitted to be reduced in accordance with 1607.9.

1607.11.2.3 Landscaped roofs. Where roofs are to be landscaped, the uniform design live load in the landscaped area shall be 20 psf (0.958 kN/m^2). The weight of the landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil.

1607.11.2.4 Awnings and canopies. Awnings and canopies shall be designed for uniform live loads as required in Table 1607.1 as well as for wind loads as specified in Section 1609.

1607.12 Crane loads. The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

1607.12.1 Maximum wheel load. The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its

runway at the location where the resulting load effect is maximum.

1607.12.2 Vertical impact force. The maximum wheel loads of the crane shall be increased by the percentages shown below to determine the induced vertical impact or vibration force:

Monorail cranes (powered)	25 percent
Cab-operated or remotely operated bridge cranes (powered)	25 percent
Pendant-operated bridge cranes (powered)	10 percent
Bridge cranes or monorail cranes with hand-geared bridge, trolley and hoist	0 percent

1607.12.3 Lateral force. The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed according to the lateral stiffness of the runway beam and supporting structure.

1607.12.4 Longitudinal force. The longitudinal force on crane runway beams, except for bridge cranes with hand-geared bridges, shall be calculated as 10 percent of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

1607.13 Interior walls and partitions. Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m^2).

Exception: Fabric partitions complying with Section 1607.13.1 shall not be required to resist the minimum horizontal load of 5 psf (0.24 kN/m^2).

1607.13.1 Fabric partitions. Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the following load conditions:

1. A horizontal distributed load of 5 psf (0.24 kN/m^2) applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.
2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch diameter (203 mm) area [50.3 square inches (32 452 mm^2)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

SECTION 1608
SNOW LOADS
RESERVED

SECTION 1609
WIND LOADS

1609.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

All exterior wall coverings and soffits shall be capable of resisting the design pressures specified for walls for components and cladding loads in accordance with Section 1609.1.1.

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapter 6 of ASCE 7. The type of opening protection required, the basic wind speed and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7.Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Note: Clarification to ASCE 7. Arrows shown on Figure 6-10 of ASCE 7 indicate that the pressure coefficients apply specifically to "Direction of MWFRS being designed." This means that the longitudinal pressure coefficients are not applicable to trusses that span in the transverse direction and, therefore, uplift reactions for trusses that span in the transverse direction would be determined by the pressure coefficients associated with those shown for the transverse direction.

Exceptions:

1. Wind tunnel tests together with applicable section 6.4 of ASCE 7.
2. Subject to the limitations of Sections 1609.1.1.1, 1609.1.2, and 1609.3, the provisions of *IBHS Guideline for Hurricane Resistant Residential Construction* shall be permitted for applicable Group R-2 and R-3 buildings for a basic wind speed of 140 mph (63 m/s) or less in Exposure B in accordance with Figure 1609 and Section 1609.4. Provisions for design wind speeds of 140 mph (63 m/s) in the Guideline shall also be permitted for buildings for a basic wind speed of 120 mph (54 m/s) or less in Exposure C in accordance with Figure 1609 and Section 1609.4 and provisions for design wind speeds of 120 mph (54 m/s) in the Guideline shall be permitted for buildings for a basic wind speed of 100 mph (45 m/s) or less in Exposure C in accordance with Figure 1609 and Section 1609.4.
3. Subject to the limitations of Sections 1609.1.1.1, 1609.1.2, and 1609.3, provisions of ANSI/AF&PA WFCM, *Wood Frame Construction Manual for One- and Two-Family Dwellings* shall be permitted for applicable wood frame buildings of Group R-3 occupancy for a basic

wind speed of 150 mph or less in accordance with Figure 1609 and Section 1609.4.

4. Designs using NAAMM FP-1001 *Specification for Design Loads of Metal Flagpoles*.
5. Subject to the limitations of Sections 1609.1.1.1, 1609.1.2, and 1609.3, the provisions of the FC&PA Guide to Concrete Masonry Residential Construction in High Wind Areas shall be permitted for applicable concrete masonry buildings of Group R-3 occupancy for a basic wind speed of 130 mph (58 m/s) or less in Exposure B and 110 mph (49 m/s) or less in Exposure C in accordance with Figure 1609 and Section 1609.4.
6. ANSI/TIA/EIA 222 shall be permitted for communication tower and steel antenna support structures and shall meet the wind loads of ASCE 7 and shall be designed by a qualified engineer.
7. Subject to the limitations of Sections 1609.1.1.1, 1609.1.2, and 1609.3, the provisions of the WPPC Guide to Wood Construction in High Wind Areas shall be permitted for applicable wood-frame buildings of Group R-3 occupancy for a basic wind speed of 130 mph (58 m/s) or less in Exposure B and 110 mph (49 m/s) or less in Exposure C in accordance with Figure 1609 and Section 1609.4.
8. Designs using AASHTO LTS-4 Structural Specifications for Highway Signs, Luminaires, and Traffic Signals.
9. Wind loads for screened enclosures shall be determined in accordance with Section 2002.4.

1609.1.1.1 Applicability. The provisions of IBHS *Guideline for Hurricane Resistant Residential Construction*, the AF&PA *Wood Frame Construction Manual for One- and Two-Family Dwellings, High Wind Areas*, the FC&PA *Guide to Concrete Masonry Residential Construction in High Wind Areas* and the WPPC *Guide to Wood Construction in High Wind Areas* are applicable only to buildings located within Exposure B or C as defined in Section 1609.4. The provisions of IBHS *Guideline for Hurricane Resistant Residential Construction*, the AF&PA *Wood Frame Construction Manual for One- and Two-Family Dwellings, High Wind Areas* and the WPPC *Guide to Wood Construction in High Wind Areas* shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C;
2. The maximum average slope of the hill exceeds 10 percent; and
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 1 mile (1.61 km), whichever is greater.

1609.1.2 Protection of openings. In wind-borne debris regions, glazing in buildings shall be impact resistant or protected with an impact resistant covering meeting the requirements of SSTD 12, ASTM E 1886 and ASTM E 1996, ANSI/DASMA 115 (for garage doors and rolling doors) or Miami-Dade TAS 201, 202 and 203 or AAMA 506 referenced therein as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the Large Missile Test.
2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the Small Missile Test.
3. Storage sheds that are not designed for human habitation and that have a floor area of 720 square feet (67 m^2) or less are not required to comply with the mandatory windborne debris impact standards of this code.
4. Openings in sunrooms, balconies or enclosed porches constructed under existing roofs or decks are not required to be protected provided the spaces are separated from the building interior by a wall and all openings in the separating wall are protected in accordance with Section 1609.1.2. Such spaces shall be permitted to be designed as either partially enclosed or enclosed structures.

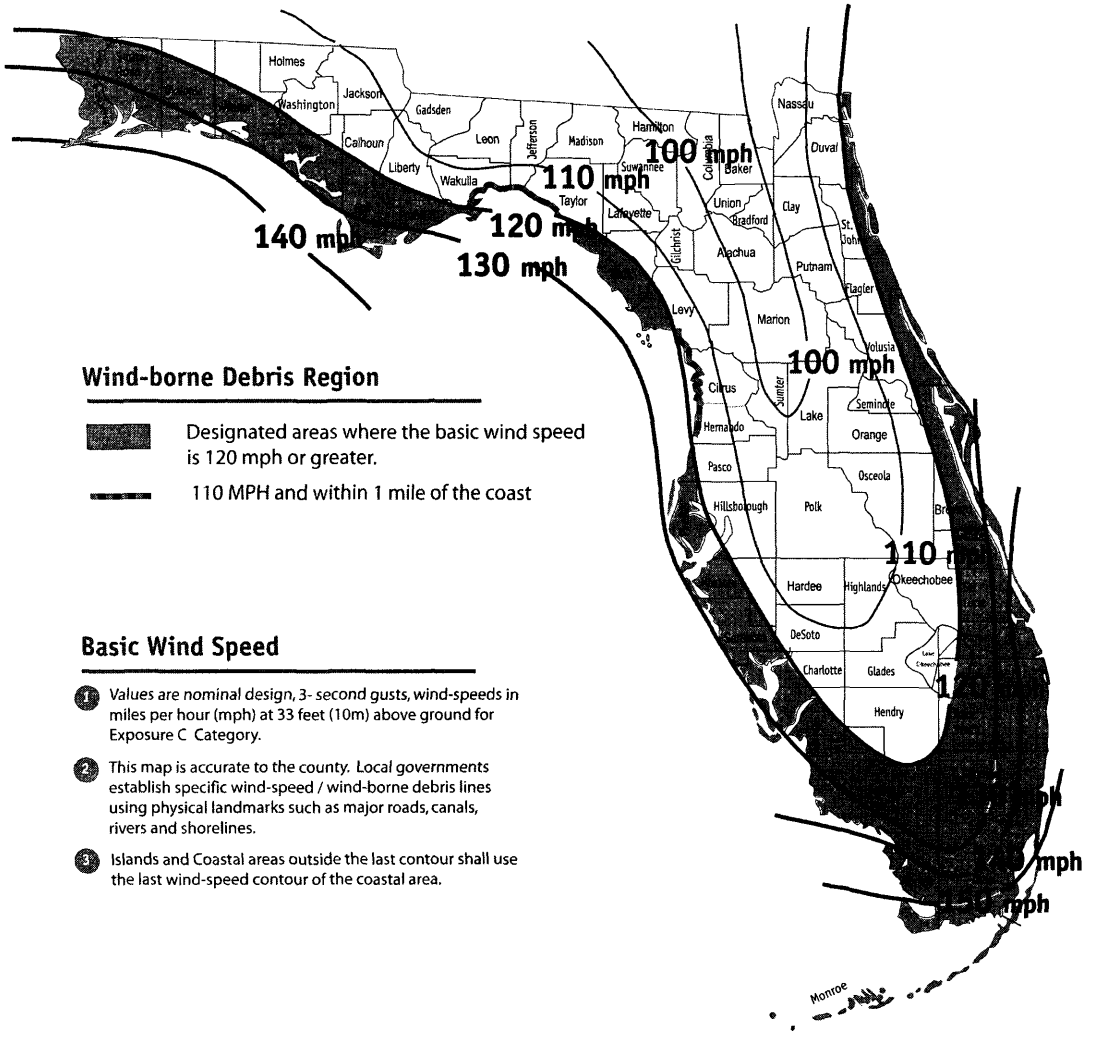
Exceptions:

1. Wood structural panels with a minimum thickness of $^{7}/_{16}$ inch (11.1 mm) and a maximum span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed openings. Panels shall be predrilled as required for the anchorage method and all required hardware shall be provided. Attachment shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with permanent corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609.1.2, with permanent corrosion resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where wind speeds do not exceed 140 mph (63 m/s)
2. Glazing in Occupancy Category I buildings as defined in Section 1604.5, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. Glazing in Occupancy Category II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458

As Amended by Law cs /HB 1A - 2007

State of Florida

Wind-Borne Debris Region



Wind-borne Debris Region

Designated areas where the basic wind speed is 120 mph or greater.

110 MPH and within 1 mile of the coast

Basic Wind Speed

1. Values are nominal design, 3- second gusts, wind-speeds in miles per hour (mph) at 33 feet (10m) above ground for Exposure C Category.
2. This map is accurate to the county. Local governments establish specific wind-speed / wind-borne debris lines using physical landmarks such as major roads, canals, rivers and shorelines.
3. Islands and Coastal areas outside the last contour shall use the last wind-speed contour of the coastal area.

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FIGURE 1609
STATE OF FLORIDA DEBRIS REGION & BASIC WIND SPEED

m) of the building shall be permitted to be unprotected.

TABLE 1609.1.2
WIND-BORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS

FASTENER TYPE	FASTENER SPACING (inches)[1,2]			
	Panel Span ≤ 2 ft	2 foot < panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
#8 Wood screw-based anchor with 2-inch embedment length[3]	16	16	10	8
#10 Wood screw-based anchor with 2-inch embedment length[3]	16	16	12	9
¼ Lag screw-based anchor with 2-inch embedment length[3]	16	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

1. This table is based on a maximum wind speed of 140 mph (63 m/s) and mean roof height of 45 feet (13 716 mm) or less.
2. Fasteners shall be installed at opposing ends of the wood structural panel.
3. Where screws are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum withdrawal capacity of 1500 lb (6673 kN).

1609.1.2.1 Louvers. Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet requirements of an approved impact-resisting standard or the Large Missile Test of ASTM E 1996.

1609.1.2.2 Impact resistant coverings.

1609.1.2.2.1 Impact resistant coverings shall be tested at 1.5 times the design pressure (positive or negative) expressed in pounds per square feet as determined by the *Florida Building Code, Building* Section 1609 for which the specimen is to be tested.

1609.1.2.2.2 Impact resistant coverings. Impact resistant coverings shall be labeled in accordance with the provisions of Section 1714.8.

1609.1.3 Optional exterior door component testing. Exterior side-hinged door assemblies shall have the option to have the components of the assembly tested and rated for impact resistance in accordance with the following specification: SDI 250.13.

1609.1.4 The wind-borne debris regions requirements shall not apply landward of the designated contour line in Figure 1609. A geographical boundary that coincides with the contour line shall be established.

1609.2 Definitions. The following words and terms shall, for the purposes of Section 1609, have the meanings shown herein.

HURRICANE-PRONE REGIONS. Areas vulnerable to hurricanes defined as:

1. The U. S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 mph (40 m/s) and
2. Hawaii, Puerto Rico, Guam, Virgin Islands and American Samoa.

WIND-BORNE DEBRIS REGION. Portions of hurricane-prone regions that are within 1 mile (1.61 km) of the coastal mean high water line where the basic wind speed is 110 mph (48 m/s) or greater; or portions of hurricane-prone regions where the basic wind speed is 120 mph (53 m/s) or greater; or Hawaii.

1609.3 Basic wind speed. The basic wind speed in miles per hour, for the development of wind loads, shall be determined from Figure1609. The exact location of wind speed lines shall be established by local ordinance using recognized physical landmarks such as major roads, canals, rivers and lake shores whenever possible.

1609.3.1 Wind speed conversion. When required, the 3-second gust basic wind speeds of Figure 1609 shall be converted to fastest-mile wind speeds, V_{fm}, using Table 1609.3.1 or Equation 16-34.

$$V_{fm} = \frac{(V_{3S} - 10.5)}{1.05} \qquad \textbf{(Equation 16-34)}$$

where:

V_{3S} = 3-second gust basic wind speed from Figure 1609.

1609.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

Exception: An intermediate exposure between the exposure categories defined is permitted in a transition zone, provided that it is determined by a rational analysis method.

1609.4.1 Wind directions and sectors. For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609.4.2 and 1609.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

1609.4.2 Surface roughness categories. A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the categories defined below, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country,

TABLE 1609.3.1
EQUIVALENT BASIC WIND SPEEDS[a,b,c]

V3S	85	90	100	105	110	120	125	130	140	145	150	160	170
Vfm	71	76	85	90	95	104	109	114	123	128	133	142	152

For SI: 1 mile per hour = 0.44 m/s.
a. Linear interpolation is permitted.
b. V_{3S} is the 3-second gust wind speed (mph).
c. V_{fm} is the fastest mile wind speed (mph).

grasslands, and all water surfaces in hurricane-prone regions.

Surface Roughness D. Reserved.

1609.4.3 Exposure categories. An exposure category shall be determined in accordance with the following:

Exposure B. Exposure B shall apply where the ground surface roughness condition, as defined by Surface Roughness B, prevails in the upwind direction for a distance of at least 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

Exception: For buildings whose mean roof height is less than or equal to 30 feet (9144 mm), the upwind distance is permitted to be reduced to 1,500 feet (457 m).

Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457.2 m) from the building site in any quadrant. This exposure shall also apply to any building located within Exposure B-type terrain where the building is within 100 feet horizontally in any direction of open areas of Exposure C-type terrain that extends more than 600 feet (182.9 m) and width greater than 150 ft. in the upwind direction. Short-term (less than two year) changes in the pre-existing terrain exposure, for the purposes of development, shall not be considered open fields. Where development buildout will occur within three years and the resultant condition will meet the definition of Exposure B, Exposure B shall be regulating for the purpose of permitting. This category includes flat open country, grasslands and ocean or gulf shorelines and shall extend downwind for a distance of 1500 feet. For buildings located within a distance of 600 feet of inland bodies of water that present a fetch of 1 mile (1.61 km) or more or inland waterways or rivers with a width of 1 mile (1.61 km) or more roof sheathing uplift and roof-to-wall uplift loads shall be increased by 20 percent.

Exposure D. This exposure category is not applicable in Florida.

1609.5 Roof systems.

1609.5.1 Roof deck. The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

1609.5.2 Roof coverings. Roof coverings shall comply with Section 1609.5.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.5.1 are permitted to be designed in accordance with Section 1609.5.3.

Asphalt shingles installed over a roof deck complying with Section 1609.5.1 shall be tested to determine the resistance of the sealant to uplift forces using ASTM D 6381.

Asphalt shingles installed over a roof deck complying with Section 1609.5.1 are permitted to be designed using UL 2390 to determine appropriate uplift and force coefficients applied to the shingle.

1609.5.3 Rigid tile. Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - GC_p] \qquad \textbf{(Equation 16-35)}$$

$$\text{For SI: } M_a = \frac{q_h C_L b L L_a \left[1.0 - GC_p\right]}{1{,}000}$$

where:

b = Exposed width, feet (mm) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1715.2.

GC_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 6 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

L = Length, feet (mm) of the roof tile.

L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at $0.76L$ from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

M_a = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.

q_h = Wind velocity pressure, psf (kN/m^2) determined from Section 6.5.10 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing which has been designed as components and cladding.
3. An underlayment shall be installed in accordance with Chapter 15.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have at least two-thirds of the tile's area free of mortar or adhesive contact.

1609.6 Garage doors and rolling doors. Pressures from Table 1609.6(1) for wind loading actions on garage doors and rolling doors for buildings designed as enclosed shall be permitted.

SECTION 1610
SOIL LATERAL LOADS

1610.1 General. Basement, foundation and retaining walls shall be designed to resist lateral soil loads. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless specified otherwise in a soil investigation report approved by the building official. Basement walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top are permitted to be designed for active pressure. Design lateral pressure from surcharge loads shall be added to the lateral earth pressure load. Design lateral pressure shall be increased if soils with expansion potential are present at the site.

Exception: Basement walls extending not more than 8 feet (2438 mm) below grade and supporting flexible floor systems shall be permitted to be designed for active pressure.

SECTION 1611
RAIN LOADS

1611.1 Design rain loads. Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow.

$$R = 5.2\,(d_s + d_h) \qquad \textbf{(Equation 16-36)}$$

For SI: $R = 0.0098\,(d_s + d_h)$

where:

d_h = Additional depth of water on the undeflected roof above the inlet of secondary drainage system at its design flow (i.e., the hydraulic head), in inches (mm).

d_s = Depth of water on the undeflected roof up to the inlet of secondary drainage system when the primary drainage system is blocked (i.e., the static head), in inches (mm).

R = Rain load on the undeflected roof, in psf (kN/m^2). When the phrase "undeflected roof" is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.

1611.2 Ponding instability. For roofs with a slope less than $^1/_4$ inch per foot [1.19 degrees (0.0208 rad)], the design calculations shall include verification of adequate stiffness to preclude progressive deflection in accordance with Section 8.4 of ASCE 7.

1611.3 Controlled drainage. Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from Section 1611.1. Such roofs shall also be checked for ponding instability in accordance with Section 1611.2.

SECTION 1612
HIGH-VELOCITY HURRICANE ZONES—GENERAL

1612.1 General design requirements.

1612.1.1 Any system, method of design or method of construction shall admit of a rational analysis in accordance with well-established principles of mechanics and sound engineering practices.

1612.1.2 Buildings, structures and all parts thereof shall be designed and constructed to be of sufficient strength to support the estimated or actual imposed dead, live, wind, and any other loads, both during construction and after completion of the structure, without exceeding the allowable materials stresses specified by this code.

1612.1.3 No building structure or part thereof shall be designed for live loads less than those specified in this Chapter or ASCE 7 with commentary, except as otherwise noted in this code.

1612.1.4 The live loads set forth herein shall be assumed to include the ordinary impact but where loading involves unusual impact, provision shall be made by increasing the assumed live load.

TABLE 1609.6(1)
GARAGE DOOR AND ROLLING DOOR WIND LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (psf)

EFFECTIVE WIND AREA		Basic Wind Speed V (mph - 3 second gust)													
Width (ft)	Height (ft)	85		90		100		110		120		130		140		150	
Roof Angle 0 - 10 degrees																	
8	8	10.5	-11.9	11.7	-13.3	14.5	-16.4	17.5	-19.9	20.9	-23.6	24.5	-27.7	28.4	-32.2	32.6	-36.9
10	10	10.1	-11.4	11.4	-12.7	14.0	-15.7	17.0	-19.0	20.2	-22.7	23.7	-26.6	27.5	-30.8	31.6	-35.4
14	14	10.0	-10.7	10.8	-12.0	13.3	-14.8	16.1	-17.9	19.2	-21.4	22.5	-25.1	26.1	-29.1	30.0	-33.4
Roof Angle > 10																	
9	7	11.4	-12.9	12.8	-14.5	15.8	-17.9	19.1	-21.6	22.8	-25.8	26.7	-30.2	31.0	-35.1	35.6	-40.2
16	7	10.9	-12.2	12.3	-13.7	15.2	-16.9	18.3	-20.4	21.8	-24.3	25.6	-28.5	29.7	-33.1	34.1	-38.0

For SI: 1 Square foot = 0.929 m^2, 1 mph = 0.447 m/s, 1 psf = 47.88 N/m^2

1. For effecctive areas or wind speeds between those given above the load may be interpolated, otherwise use the load associated with the lower effective area.
2. Table values shall be adjusted for height and exposure by multiplying by adjustment coefficients in Table 1609.6(2).
3. Plus and minus signs signify pressures acting toward and away from the building surfaces.
4. Negative pressures assume door has 2 feet of width in building's end zone.

TABLE 1609.6(2)
ADJUSTMENT FACTOR FOR BUILDING HEIGHT AND EXPOSURE, (λ)

MEAN ROOF HEIGHT (feet)	EXPOSURE		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

For SI: 1 foot = 304.8 mm.

a. All table values shall be adjusted for other exposures and heights by multiplying by the above coefficients.

TABLE 1610.1
SOIL LATERAL LOAD

DESCRIPTION OF BACKFILL MATERIAL[c]	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD[a] (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.

b. Unsuitable as backfill material.

1612.1.5 In the design of floors, not less than the actual live load to be imposed shall be used. Special provisions shall be made for machine or apparatus loads where applicable.

1612.1.6 Floor and roof systems shall be designed and constructed to transfer horizontal forces to such parts of the structural frame as are designed to carry these forces to the foundation. Where roofs or floors are constructed of individual prefabricated units and the transfer of forces to the building frame and foundation is totally or partially dependent on such units, the units and their attachments shall be capable of resisting applied loads in both vertical and both horizontal directions. Where roofs or floors are constructed of individual prefabricated units and the transfer of forces to the building frame and foundation is wholly independent of such units, the units and their attachments shall be capable of resisting applied loads normal to the surface, in and out..

1612.2 General design for specific occupancies and structures.

1612.2.1 Fences. Fences not exceeding 6 feet (1829 mm) in height from grade may be designed for 75 mph (33 m/s) fastest mile wind speed or 90 mph (40 m/s) 3-second gust.

1612.2.1.1 Wood fences. Wood fence design shall be as specified by Section 2328.

1612.2.2 Sway forces in stadiums.

1. The sway force applied to seats in stadiums, grandstands, bleachers and reviewing stands shall be not less than 24 pounds per lineal foot (350 N/m), applied perpendicularly and along the seats.
2. Sway forces shall be applied simultaneously with gravity loads.
3. Sway forces need not be applied simultaneously with other lateral forces.

SECTION 1613
HIGH-VELOCITY HURRICANE ZONES—DEFLECTION

1613.1 Allowable deflections. The deflection of any structural member or component when subjected to live, wind and other superimposed loads set forth herein shall not exceed the following:

1. Roof and ceiling or components supporting plaster L/360
2. Roof members or components not supporting plaster under L/240

3. Floor members or components L/360
4. Vertical members and wall members or components consisting of or supporting material that hardens in place, is brittle or lacks resistance to cracking caused by bending strains L/360
5. Vertical members and wall members or components not required to meet the conditions of Section 1613.1, item 4. . . . . L/180
6. Roof and vertical members, wall members and panels of carports, canopies, marquees, patio covers, utility sheds and similar minor structures not to be considered living areas, where the roof projection is greater than 12 feet (3.7 m) in the direction of the span, for free-standing roofs and roofs supported by existing structures. Existing structures supporting such roofs shall be capable of supporting the additional loading L/180
7. For Group R3 occupancies only, roof and vertical members, wall members and panels of carports, canopies, marquees, patio covers, utility sheds and similar minor structures not to be considered living areas, where the roof projection is 12 feet (3.7 m) or less in the direction of the span and for free standing roofs and roofs supported by existing structures L/80
8. Members supporting screens only L/80
9. Storm shutters and fold-down awnings, which in the closed position shall provide a minimum clear separation from the glass of 1 inch (25 mm) but not to exceed 2 inches (51 mm) when the shutter or awning is at its maximum point of permissible deflection L/30
10. Roofs and exterior walls of utility sheds having maximum dimensions of 10 feet (3 m) length, 10 feet (3 m) width, and 7 feet (2.1 m) height L/80
11. Roofs and exterior walls of storage buildings larger than utility sheds L/180

SECTION 1614
HIGH-VELOCITY HURRICANE ZONES—VOLUME CHANGES

1614.1 Volume change. In the design of any building, structure or portion thereof, consideration shall be given to the relief of stresses caused by expansion, contraction and other volume changes.

SECTION 1615
HIGH-VELOCITY HURRICANE ZONES—MINIMUM LOADS

1615.1 Live loads. Minimum uniformly distributed live loads shall not be less than as set forth in and Table 4-1 of ASCE 7 with commentary, except as otherwise noted in this code.

1615.2 Concentrated loads. Minimum concentrated loads shall not be less than as set forth in Table 4-1 of ASCE 7 with commentary, except as otherwise noted.

1615.2.1 Concentrated loads on trusses. Any single panel point of the lower chord of roof trusses or any point of other primary structural members supporting roofs over manufacturing, commercial storage and warehousing, and commercial garage floors shall be capable of safely carrying a suspended, concentrated load of not less than 2,000 pounds (8896 N) in addition to dead load. For all other occupancies, a minimum load of 200 pounds (890 N) shall be used.

TABLE 1615
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
See Tables 4-1 of ASCE 7 with commentary, except as otherwise noted below

OCCUPANCY OR USE	LIVE LOAD POUNDS PER SQUARE FOOT
Assembly projection room	100
Balconies, Exterior (see also assembly) Serving private units of Group R occupancies and not for assembly use	60
Balconies serving occupancies 80 psf or less	80
All other balconies	100
Cabanas and bath house	50
Path of egress servicing occupancies 80 psf or less	80
Path of egress servicing occupancies over 80 psf	100
Recreational facilities Including bowling centers, pool rooms and similar uses	75
Storage: Light Medium Heavy	 75 125 250[1,2]

For SI: 1 pound per square foot = 47.88 Pa.
1. Use actual equipment weight when greater.
2. Increase when occupancy exceeds this amount.

SECTION 1616
HIGH-VELOCITY HURRICANE ZONES—ROOF LIVE LOADS

1616.1 Minimum roof live loads. Roofs shall be designed for a live load of not less than 30 psf (1436 Pa), except as set forth herein.

Exceptions:

1. Glass areas of greenhouse roofs shall be designed for a live load of not less than 15 psf (718 Pa).
2. Ordinary pitched and curved roofs, with a slope of $1^1/_2$:12, or greater, where water is not directed to the interior of the roof, without parapet or other edge of roof drainage obstructions, may be designed for an allowable live load of not less than 20 psf (958 Pa).
3. Utility sheds shall be designed for a live load of not less than 15 psf (718 Pa).

1616.2 Special purpose roofs. Roofs used for assembly, roof gardens, promenade or walkway purposes shall be designed for a minimum live load of 100 psf (4788 Pa). Other special

purpose roofs shall be designed for appropriate loads as directed or approved by the building official.

1616.3 Roof decking. Roof decking shall be designed to support the live load set forth in 1616.1 or a load of 100 pounds per foot (445 N) applied as a 1 foot (305 mm) wide strip perpendicular to, and at the center of, the span of the decking between supports, whichever is more critical.

SECTION 1617
HIGH-VELOCITY HURRICANE ZONES—ROOF DRAINAGE

1617.1 Roof drainage. Where parapets or curbs are constructed above the level of the roof, provision shall be made to prevent rain water from accumulating on the roof in excess of that considered in the design, in the event the rain water drains, conductors or leaders become clogged.

1617.2 Where roofs are not designed in accordance with Section 1617.1, overflow drains or scuppers shall be placed to prevent an accumulation of more than 5 inches (927 mm) of water on any portion of the roof. In determining the load that could result should the primary drainage system be blocked, the loads caused by the depth of water (i.e., head) needed to cause the water to flow out the scuppers or secondary drainage system shall be included.

1617.3 Drains or scuppers installed to provide overflow drainage shall be not less in aggregate area than as shown in Figure 1617.3, but not less than 4 inches (102 mm) dimension in any direction and shall be placed in parapets not less than 2 inches (51 mm) nor more than 4 inches (102 mm) above the low point of the finished roofing surface and shall be located as close as practical to required vertical leaders, conductors or downspouts. The roof area to be taken in the sizing of the scuppers is the horizontal projection, except that, where a building wall extends above the roof in such a manner as to drain into the area considered, the one-half of the area of the vertical wall shall be added to the horizontal projection.

1617.4 All roofs shall be designed with sufficient slope or camber to assure adequate drainage after the long term deflection from dead load, or shall be designed to support maximum loads including possible ponding of water caused by deflection.

1617.5 Ponding loads. Roofs shall be designed to preclude instability from ponding loads.

1617.6 Each portion of a roof shall be designed to sustain the loads of all rainwater that could accumulate on it if the primary drainage system for that portion is obstructed. Ponding instability shall be considered in this situation. If the overflow drainage provisions contain drain lines, such lines shall be independent of any primary drain lines.

SECTION 1618
HIGH-VELOCITY HURRICANE ZONES—SPECIAL LOAD CONSIDERATIONS

1618.1 Floors. In the design of floors, consideration shall be given to the effect of known or probable concentration of loads, partial concentrations of loads, partial load, vibratory, transitory, impact and machine loads. Design shall be based on the load or combination of loads that produces the higher stresses.

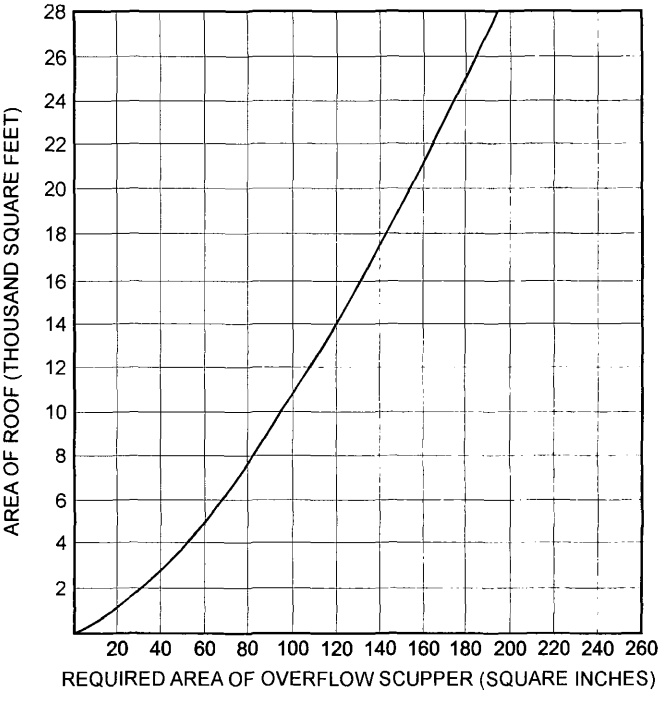


FIGURE 1617.3
REQUIRED AREA OF OVERFLOW SCUPPERS

1618.2 Below grade structures.

1618.2.1 In the design of basements, tanks, swimming pools and similar below grade structures, provisions shall be made for the forces resulting from hydrostatic pressure and lateral pressure of adjacent soil.

1618.2.2 For the lateral loads of soil on below grade structures, unless substantiated by more specific information, the angle of repose of fragmental rock and natural confined sand shall be 30 degrees and the angle of repose of filled soil and muck shall be 15 degrees to a horizontal line.

1618.2.3 For the hydrostatic pressure on any floor below a ground water level, calculations shall be based on full hydrostatic pressure, and such floors shall be designed for live load without hydrostatic uplift, and hydrostatic uplift without live load.

1618.2.4 Private swimming pools may be designed with an approved hydrostatic relief valve or other device capable of preventing the pool water from being pumped to a level lower than the surrounding ground water but such device shall not be credited for more than 2 feet (610 mm) of the difference of head between the pool bottom and the flood criteria.

1618.3 Helistops/heliports. In addition to other design requirements of this chapter, heliport and helistop loading or touchdown areas shall be designed for the maximum stress induced by the following:

1. Dead load plus actual weight of the helicopter.

2. Dead load plus two single concentrated impact loads approximately 8 feet (2.4 m) apart anywhere on the touchdown pad (representing each of the helicopter's two main landing gear, whether skid type or wheeled type), with each concentrated load covering 1 square foot (0.09 m^2) and having a minimum magnitude of 0.75 times the gross weight of the helicopter. Both loads acting together total a minimum of 1.5 times the gross weight of the helicopter.
3. The dead load plus a uniform live load of 60 psf (2873 Pa).

1618.4 Safeguards. Safeguards shall be required in and around buildings and structures such as covers, railings, stair-railings, handrails or other safeguards as defined in the regulations of the Occupational Safety and Health Administration (OSHA) 29 CFR Part 1910 as applied to permanent structures and as specified herein.

1618.4.1 Open or glazed wall openings; open or glazed sides of balconies, landings and other walking surfaces; unenclosed floor and roof openings; roofs used for other than services for the building or structure and any other abrupt differences in level exceeding 30 inches (762 mm), including yard areas, shall be provided with safeguards not less than 42 inches (1067 mm) in height.

1618.4.2 Safeguards may be omitted at loading docks, truck wells and similar locations where it is apparent that the edge of the higher level is for loading, and on docks, seawalls and decorative fountains where the lower level is the water surface.

1618.4.3 Safeguards in and around buildings of other than Group R occupancies shall be provided with additional rails, vertical pickets or ornamental filler below the top rail that will reject a 6-inch (152 mm) diameter object.

1618.4.4 Safeguards in and around buildings of Group R occupancies shall provide protection for children by providing additional rails, vertical pickets or an ornamental filler below the top rail which will reject a 4-inch (102 mm) diameter object; permitting, however, such ornamental fillers to have individual openings not exceeding 64 square inches (.04 m^2) in area.

1618.4.5 Where a balustrade is used to comply with the requirements of this paragraph, the maximum clearance between the bottom rail of the balustrade and the adjacent surface shall not exceed 2 inches (51 mm). For safeguards on stairs, the 2-inch (51 mm) clearance shall be measured from the bottom rail of the balustrade to a line passing through the tread nosings.

1618.4.6 Railing.

1618.4.6.1 Railings, stair-railings and other similar safeguards shall be designed to resist a load of 50 pounds per lineal foot (74 kg/m) or a concentrated load of 200 pounds (690 N) applied in any direction at the top of such barriers at any location on the safeguard, whichever condition produces the maximum stresses. The reactions and stresses caused by the above referenced uniform and concentrated loads shall be considered not be acting simultaneously.

1618.4.6.2 Intermediate rails, balusters and panel fillers shall be designed for a uniform horizontal load of not less than 25 psf (1197 Pa) over the gross area of the guard, including the area of any openings in the guard, of which they are a part without restriction by deflection. Reactions resulting from this loading need not be added to the loading specified in Section 1618.4.6.1 in designing the main supporting members of guards.

1618.4.6.3 Safety glazing will be permitted as an equal alternate to pickets, if tested by an accredited laboratory to satisfy the resistance requirements of this code for wind, live and kinetic energy impact loading conditions. The kinetic energy impact loading shall comply with ANSI Z97.1 using a 400 foot-pound (542 N) energy impact. The safety requirements of the impact test shall be judged to have been satisfactorily met if breakage does not occur or numerous cracks and fissures occur but no shear or opening through which a 3-inch (76 mm) diameter sphere may freely pass. The glass panel shall remain within the supporting frame.

1618.4.6.4 If the posts that support the top rail of exterior railings are substituted with glass, the assembly shall be tested to TAS 201, where the impacted glass continues to support the top rail and all applicable loads after impact.

1618.4.7 Areas in all occupancies from which the public is excluded requiring such protection may be provided with vertical barriers having a single rail midway between a top rail and the walking surface.

1618.4.8 The last sentence of the first paragraph in Section 4.4.2 of ASCE 7 is hereby deleted.

1618.5 Vehicle safeguard barriers. Vehicle safeguard barriers are required in parking garages whenever there is a difference in level exceeding 1 foot (305 mm).

1618.5.1 Unless separate pedestrian safeguards are provided vehicle safeguard barriers shall, in addition to the requirements of this section, meet all other requirements of Section 1618.4.

1618.5.2 The requirement of Section 1618.4.3 for the rejection of a 6-inch (152 mm) diameter object shall be met when the barrier is subjected to a horizontal load of 25 psf (1197 Pa), applied as specified in Section 1618.4.6.2.

1618.5.3 Vehicle safeguard barriers shall be capable of resisting a minimum horizontal ultimate load of 10,000 pounds (44.5 kN) applied 18 inches (457 mm) above the floor at any point in the barrier system. This load need not be applied in combination with loads specified in Section 1618.4.6.1 and Section 1618.4.6.2. Vehicle safeguard barrier systems of metal framing, concrete or masonry may be designed by allowable stress design for a concentrated horizontal load of 7,500 pounds (33 361 N) in lieu of the 10,000 pounds (44.5 kN) ultimate load specified above.

1618.6 Special requirements for cable safeguard barriers.

1618.6.1 Horizontal deflection under design load shall not exceed 18 inches (457 mm).

1618.6.2 The design load shall be assumed to be resisted by not more than two cables.

1618.6.3 The cable system including anchors shall be protected against corrosion.

1618.6.4 Cable tension under design load shall not exceed 90 percent of the yield strength of the cable.

1618.6.5 The uppermost cable shall be at least 42 inches (1067 mm) above the adjacent surface. Cables shall not be spaced more than 6 inches (152 mm) apart.

1618.6.6 An installation plan prepared by the structural engineer of record shall be submitted to the building official for his or her approval.

1618.6.7 Installation shall be witnessed by the structural engineer of record who shall certify the following:

1. That the installation has been in accordance with the approved installation plan.
2. That the initial tension designated by the structural engineer of record has been provided in all cables.
3. That all anchors have been seated at a total load, including initial tension, equal to 85 percent of the yield strength of the cable, unless a positive locking device is provided that does not require a tension jack for the tensioning of the barrier strand.

1618.6.8 Drawings shall indicate the initial tension, the expected increase in tension under vehicular impact and the required maximum capacity of the strand barrier system.

1618.7 Ornamental projections. Ornamental cantilevered projections on the exterior of buildings shall be designed for not less than 60 psf live load (2873 Pa) or 200 pounds per lineal foot (2919 N/m) applied at the outer edge, whichever is more critical.

1618.8 Interior wall and partitions. Permanent, full-height interior walls and partitions shall be designed to resist a lateral live load not less than 5 psf (239 Pa) and if sheathed with lath and plaster, deflection at this load shall not exceed L/360.

1618.9 Load combination. The safety of structures shall be checked using the provisions of 2.3 and 2.4 of ASCE 7 with commentary.

Exception: Increases in allowable stress shall be permitted in accordance with ACI 530/ASCE 5/TMS 402 provided the load reduction factor of 0.75 of combinations 4 and 6 of ASCE 7 Section 2.4.1 shall not be applied.

SECTION 1619
HIGH VELOCITY HURRICANE ZONES — LIVE LOAD REDUCTIONS

1619.1 Application. No reduction in assumed live loads set forth in this section shall be allowed in the design of columns, walls, beams, girders and foundations, except as permitted by the provisions of Section 4.8 ASCE 7 with commentary.

Exceptions:

1. No reduction of the assumed live loads shall be allowed in the design of any slabs, joists or other secondary members, except as set forth herein.
2. No reduction in roof live loads shall be permitted except as set forth by Section 1616.1.

1619.2 Allowable live load reductions.

1619.2.1 Permissible reduction in live loads shall be as provided in Section 4.8.1 of ASCE 7 with commentary.

1619.2.2 Limitations on live load reduction shall be as noted in Section 4.8.2 of ASCE 7 with commentary.

1619.2.3 No reduction in live loads shall be permitted for buildings or structures of Group A assembly occupancy.

SECTION 1620
HIGH-VELOCITY HURRICANE ZONES— WIND LOADS

1620.1 Buildings and structures, and every portion thereof, shall be designed and constructed to meet the requirements of Section 6 of ASCE 7, as more specifically defined in this section, based on a 50-year mean recurrence interval.

1620.2 Wind velocity (3-second gust) used in structural calculations shall be 140 miles per hour (63 m/s) in Broward County and 146 miles per hour (65 m/s) in Miami-Dade County.

1620.3 All buildings and structures shall be considered to be in Exposure Category C as defined in Section 6.5.6.3 of ASCE 7.

1620.4 For wind force calculations, roof live loads shall not be considered to act simultaneously with the wind load.

1620.5 Utility sheds shall be designed for a wind load of not less than 15 psf (718 Pa).

SECTION 1621
HIGH-VELOCITY HURRICANE ZONES— OVERTURNING MOMENT AND UPLIFT

1621.1 Computations for overturning moment and uplift shall be based on ASCE 7.

1621.2 Overturning and uplift stability of any building, structure or part thereof taken as a whole shall be provided, and shall be satisfied by conforming to the load combination requirements of ASCE 7.

SECTION 1622
HIGH-VELOCITY HURRICANE ZONES— SCREEN ENCLOSURES

1622.1 Screen enclosures.

1622.1.1 The wind loads on screen surfaces shall be per ASCE 7 Table 6-12 based on the ratio of solid to gross area.

1622.1.2 Design shall be based on such loads applied horizontally inward and outward to the walls with a shape factor of 1.3 and applied vertically upward and downward on the roof with a shape factor of 0.7.

SECTION 1623
HIGH-VELOCITY HURRICANE ZONES—
LIVE LOADS POSTED AND OCCUPANCY PERMITS

1623.1 Live loads posted. The live loads in every building, structure or part thereof of Group F, M or S Storage occupancy approved by the building official shall be shown on plates supplied by the owner or his authorized agent, in that part of each space to which such loads apply.

1623.1.1 Such plates shall be of approved durable materials displaying letters and figures not less than $^3/_8$ inch (9.5 mm) in height, and shall be securely affixed to the structure in conspicuous places.

1623.1.2 Such notices shall not be removed or defaced and where defaced, removed or lost, it shall be the responsibility of the owner to cause replacement as soon as possible.

1623.2 Occupant loads. Plans for proposed buildings or structures of Group F, M or S storage occupancy areas in buildings of any occupancy shall show the allowable loading for each portion of the floor and roof areas and certificates of use and occupancy, as defined in Section 110 of this code, shall not be issued until such loads are posted as set forth in Section 1623.1.

1623.2.1 Change in occupant load. No change in the occupancy of any building shall be made until a certificate of occupancy has been issued certifying that the building official has approved the building as suitable for the loads characteristic of the proposed occupancy.

1623.2.2 Maximum floor and roof loads observed. It shall be unlawful at any time to place, or permit to be placed, on any floor or roof of a building or structure, a load greater than that for which the floor or roof is approved by the building official.

SECTION 1624
HIGH-VELOCITY HURRICANE ZONES—
FOUNDATION DESIGN

1624.1 Design procedure. The minimum area of a footing or number of piles under a foundation shall be determined in the following manner:

1624.1.1 The total load of the column that has the largest percentage of the live load to the total load shall be divided by the allowable soil pressure or pile capacity.

1624.1.2 The balance soil pressure or pile capacity shall be determined by dividing the total dead load by the area of the footing or the number of piles.

1624.1.3 The minimum area of other footings or number of piles shall be designed on the basis of their respective dead loads only.

1624.1.4 In no case shall the total load of the combined dead, live, wind and any other loads exceed the allowable bearing pressure of the soil for capacity of any pile upon which the foundation is supported.

1624.1.5 The live load used in the above calculations may be the total reduced live load in the member immediately above the foundation.

1624.1.6 The building official may require submittal of design computations employed in foundation design.

1624.2 Wind effects. Reserved.

1624.2.1 Reserved.

SECTION 1625
HIGH-VELOCITY HURRICANE ZONES—
LOAD TESTS

1625.1 Application. Whenever there is insufficient evidence of compliance with the provisions of this code or evidence that any material or any construction does not conform to the requirements of this code, or in order to substantiate claims for alternate materials or methods of construction, the building official may require testing by an approved agency, at the expense of the owner or his agent, as proof of compliance. Testing methods shall be as specified by this code for the specific material.

1625.2 Testing method. Such testing shall follow a nationally recognized standard test, or when there is no standard test procedure for the material or assembly in question, the building official shall require the material or assembly under dead plus live load shall deflect not more than as set forth in Section 1613, and that the material or assembly shall sustain dead load plus twice the live load for a period of 24 hours, with a recovery of at least 80 percent or a 100 percent recovery after one-half test load.

1625.3 Alternate test methods. When elements, assemblies or details of structural members are such that their load-carrying capacity, deformation under load, or deflection cannot be calculated by rational analysis, their structural performance shall be established by test in accordance with test procedures as approved by the building official based on consideration of all probable conditions of loading.

1625.4 Fatigue load testing. Where cladding assemblies (including cladding and connections) or roofing framing assemblies (including portions of roof structure and connections) are such that their load-carrying capacity or deformation under load cannot be calculated by rational analysis, the assemblies may be tested to resist the fatigue loading sequence given by Table 1625.4.

TABLE 1625.4
FATIGUE LOADING SEQUENCE

RANGE OF TEST	NUMBER OF CYCLES[1]
0 to $0.5p^2$	600
0 to 0.6p	70
0 to 1.3p	1

1. Each cycle shall have minimum duration of 1 second and a maximum duration of 3 seconds and must be performed in a continuous manner.
2. p = the design wind load for the height and location, when the assembly will be used. For wall and roof components, shape factors given in ASCE 7 shall be used.

Assemblies shall be tested with no resultant failure or distress and shall have a recovery of at least 90 percent over maximum deflection.

Any cladding assembly not incorporated into the *Florida Building Code, Building* after successfully completing the impact test outlined in Section 1626, shall be subject to fatigue loading testing and shall obtain product approval by the building official.

SECTION 1626
HIGH-VELOCITY HURRICANE ZONES—IMPACT TESTS FOR WIND-BORNE DEBRIS

1626.1 All parts or systems of a building or structure envelope such as, but not limited, to exterior walls, roof, outside doors, skylights, glazing and glass block shall meet impact test criteria or be protected with an external protection device that meets the impact test criteria. Test procedures to determine resistance to wind-borne debris of wall cladding, outside doors, skylights, glazing, glass block, shutters and any other external protection devices shall be performed in accordance with this section.

Exception: The following structures or portion of structures shall not be required to meet the provisions of this section:

a. Roof assemblies for screen rooms, porches, canopies, etc. attached to a building that do not breach the exterior wall or building envelope and have no enclosed sides other than screen.

b. Soffits, soffit vents and ridge vents. Size and location of such vents shall be detailed by the designer and shall not compromise the integrity of the diaphragm boundary.

c. Vents in a garage with four or fewer cars. Size and location of such vents shall be detailed by the designer and shall not exceed the minimum required area by more than 25 percent.

d. Exterior wall or roof openings for wall- or roof-mounted HVAC equipment.

e. Openings for roof-mounted personnel access roof hatches.

f. Storage sheds that are not designed for human habitation and that have a floor area of 720 square feet (67 m^2) or less are not required to comply with the mandatory windborne debris impact standards of this code.

g. Louvers as long as they properly considered ASCE 7 in the design of the building.

h. Buildings and structures for marinas, cabanas, swimming pools, solariums and greenhouses.

1626.2 Large missile impact tests.

1626.2.1 This test shall be conducted on three test specimens. This test shall be applicable to the construction units, assemblies and materials to be used up to and including 30 feet (9.1 m) in height in any and all structures.

1626.2.2 The test specimens shall consist of the entire assembled unit, including frame and anchorage as supplied by the manufacturer for installation in the building, or as set forth in a referenced specification, if applicable. Fasteners used in mounting the test specimen shall be identical in size and spacing to what is used in field installations.

1626.2.3 The large missile shall be comprised of a piece of timber having nominal dimensions of 2 inches by 4 inches (51 mm by 102 m) weighing 9 pounds (4.1 kg).

1626.2.4 The large missile shall impact the surface of each test specimen at a speed of 50 feet per second (15.2 m/s).

1626.2.5 Each test specimen shall receive two impacts except as noted in Sections 1626.2.5.1 and 1626.2.5.2, the first within a 5-inch (127 mm) radius circle having its center on the midpoint of the test specimen and the second within a 5-inch (127 mm) radius circle in a corner having its center in a location 6 inches (152 mm) away from any supporting members.

1626.2.5.1 For window, glass block, fixed glass and skylight assemblies, both impacts shall be to glass or other glazing infill. For test specimens with more than one light of glass, a single light closest to the center of the assembly shall be selected and impacted twice in accordance with Section 1626.2.5. If a light of glass is sufficiently small to cause the 5-inch (127 mm) radius circle to overlap, two separate lights shall be impacted one time each.

1626.2.5.1.1 For window, fixed glass and skylight assemblies comprised of different glass thickness, types of glass or different types of glazing infill, each separate thickness or type shall be impacted twice in accordance with Section 1626.2.5.

1626.2.5.2 For doors, wall cladding and external protection devices, both impacts shall be to the thinnest section through the assembly. For doors, wall cladding and external protection devices with horizontal and/or vertical bracing, both impacts shall be within a single area that is not reinforced and shall be in accordance with Section 1626.2.5.

1626.2.5.2.1 For doors with glass, the glass shall be impacted twice and the thinnest section through the assembly that is not glass shall be impacted twice in accordance with Section 1626.2.5.

1626.2.6 In the case of glazing, if the three test specimens that comprise a test successfully reject the two missile impacts, they shall then be subjected to the cyclic pressure loading defined in Table 1626.

1626.2.6.1 If external protection devices are employed to protect windows, fixed doors or skylights, they must resist the large missile impacts specified in Sections 1626.2.3 and 1626.2.4 without deformations which result in contact with the windows, fixed glass, glass block, and doors or skylights they are intended to protect.

1626.2.6.2 If external protection devices are not designed to be air tight, following the large missile impact test, they must resist an application of force corresponding to those listed in Table 1625.4 (fatigue load testing) without detaching from their mountings. The acting pressure cycles shall be simulated with loads applied through a mechanical system attached to the shutter specimen to apply uniformly around the shutter perimeter a force equal to the product of the required pressure and the area of the shutter specimen.

1626.2.7 If air leakage through the test specimen is excessive, tape may be used to cover any cracks and joints through which leakage is occurring. Tape shall not be used when there is a probability that it may significantly restrict differential movement between adjoining members. It is also permissible to cover both sides of the entire specimen and mounting panel with a single thickness of polyethylene film no thicker than 0.050 mm (2 mils). The technique of application is important in order that the full load is transferred to the specimen and that the membrane does not prevent movement or failure of the specimen. Apply the film loosely with extra folds of material at each corner and at all offsets and recesses. When the load is applied, there shall be no fillet caused by tightness of plastic film.

1626.2.8 A particular system of construction shall be deemed to comply with this recommended practice if three test specimens reject the two missile impacts without penetration and resist the cyclic pressure loading with no crack forming longer than 5 inches (127 mm) and $^{1}/_{16}$ inch (1.6 mm) wide through which air can pass.

1626.2.9 If only one of the three test specimens in a test fails to meet the above listed criteria, one retest of this system of construction (another test sequence with three specimens) shall be permitted.

1626.3 Small missile impact test.

1626.3.1 This test shall be conducted on three test specimens. This test shall be applicable to the construction units, assemblies, and materials to be used above 30 feet (9.1 m) in height in any and all structures.

1626.3.2 Each test specimen shall consist of the entire assembled unit, including frame and anchorage as supplied by the manufacturer for installation in the building, or as set forth in a referenced specification, if applicable. The fasteners used in mounting the test specimen shall be identical in size and spacing to those to be used in field installations.

1626.3.3 The missiles shall consist of solid steel balls each having a mass of 2 grams (0.07 oz) (+/-5 percent) with a $^{5}/_{16}$-in. (7.9 mm) nominal diameter.

1626.3.4 Each missile shall impact the surface of each test specimen at a speed of 130 feet per second (40 m/s).

1626.3.5 Each test specimen shall receive 30 small missile impacts except as noted in Sections 1626.3.5.1 and 1626.3.5.2 delivered in groups of 10 at a time: the first 10 distributed uniformly over a 2 square foot (0.19 m^2) area located at the center of the test specimen, the second 10 distributed uniformly over a 2 square foot area (0.19 m^2) located at the center of the long dimension of the specimen near the edge, and the third 10 distributed uniformly over a 2 square foot (0.19 m^2) area located at a corner of the specimen.

1626.3.5.1 For window and skylight assemblies, all impacts shall be to glass or other glazing infill. For test specimens with more than one light of glass, a single light closest to the center of the assembly shall be selected and impacted in accordance with Section 1626.3.5. If a light of glass is sufficiently small to cause the 5-inch (127 mm) radius circles to overlap, separate lights may be impacted; however, there must be a total of 30 impacts within the assembly.

1626.3.5.1.1 For window, fixed glass and skylight assemblies comprised of glass with different thickness, types of glass or different types of glazing infill, each separate thickness or type shall be impacted in accordance with Section 1626.3.5.

1626.3.5.2 For doors, wall cladding and external protection devices, all impacts shall be to the thinnest section through the assembly. For doors, wall cladding and external protection devices with horizontal and/or vertical bracing, all impacts shall be within a single area that is not reinforced and shall be impacted in accordance with Section 1626.3.5.

1626.3.5.2.1 For doors with glass, the glass shall be impacted in accordance with Section 1626.3.5 and the thinnest section through the assembly that is not glass shall be impacted in accordance with Section 1626.3.5.

1626.3.6 In the case of glazing, after completion of the small missile impacts, each test specimen shall then be subjected to the cyclic pressure loading defined in Table 1626.

1626.3.6.1 If external protection devices are employed to protect windows, doors or skylights, they must resist the small missile impacts specified in Sections 1626.3.3 and 1626.3.4 without deformations that result in contact with the windows, glass, doors or skylights they are intended to protect.

1626.3.6.2 If external protection devices are not designed to be air tight, following the small missile impact test, they must resist an application of force corresponding to those listed in Table 1625.4 (fatigue load testing) without detaching from their mountings. The acting pressure cycles shall be simulated with loads applied through a mechanical system attached to the shutter specimen to apply uniformly around the shutter perimeter a force equal to the product of the required pressure and the area of the shutter specimen.

1626.3.7 If air leakage through the test specimen is excessive, tape may be used to cover any cracks and joints through which leakage is occurring. Tape shall not be used when there is a probability that it may significantly restrict differential movement between adjoining members. It is also permissible to cover both sides of the entire specimen and mounting panel with a single thickness of polyethylene film no thicker than 0.050 mm (2 mils). The technique of application is important for the full load to be transferred to the specimen and to insure the membrane does not prevent movement or failure of the specimen. Apply the film loosely with extra folds of material at each corner and at all offsets and recesses. When the load is applied, there shall be no fillet caused by tightness of plastic film.

1626.3.8 A particular system of construction shall be deemed to comply with this test if three test specimens reject the small missile impacts without penetration and resist the cyclic pressure loading with no crack forming longer than 5

TABLE 1626
CYCLIC WIND PRESSURE LOADING

INWARD ACTING PRESSURE		OUTWARD ACTING PRESSURE	
RANGE	NUMBER OF CYCLES[1]	RANGE	NUMBER OF CYCLES[1]
0.2 P_{MAX} to 0.5 P_{MAX}[2]	3,500	0.3 P_{MAX} to 1.0 P_{MAX}	50
0.0 P_{MAX} to 0.6 P_{MAX}	300	0.5 P_{MAX} to 0.8 P_{MAX}	1,050
0.5 P_{MAX} to 0.8 P_{MAX}	600	0.0 P_{MAX} to 0.6 P_{MAX}	50
0.3 P_{MAX} to 1.0 P_{MAX}	100	0.2 P_{MAX} to 0.5 P_{MAX}	3,350

NOTES:
1. Each cycle shall have minimum duration of 1 second and a maximum duration of 3 seconds and must be performed in a continuous manner 1.
2. P_{MAX} denotes maximum design load in accordance with ASCE 7. The pressure spectrum shall be applied to each test specimen beginning with inward acting pressures followed by the outward acting pressures in the order from the top of each column to the bottom of each column.

inches (127 mm) and $^1/_{16}$ inch (1.6 mm) in width through which air can pass.

1626.3.9 If only one of the three test specimens in a test fails to meet the above listed criteria, one retest of the system (another test sequence with three specimens) of construction shall be permitted.

1626.4 Construction assemblies deemed to comply with Section 1626.

1. Exterior concrete masonry walls of minimum nominal 8-inch (203 mm) thickness, constructed in accordance with Chapter 21 (High-Velocity Hurricane Zones) of this code.
2. Exterior frame walls or gable ends constructed in accordance with Chapter 22 and Chapter 23 (High-Velocity Hurricane Zones) of this code, sheathed with a minimum $^{19}/_{32}$-inch (15 mm) CD exposure 1 plywood and clad with wire lath and stucco installed in accordance with Chapter 25 of this code.
3. Exterior frame walls and roofs constructed in accordance with Chapter 22 (High-Velocity Hurricane Zones) of this code sheathed with a minimum 24-gage rib deck type material and clad with an approved wall finish.
4. Exterior reinforced concrete elements constructed of solid normal weight concrete (no voids), designed in accordance with Chapter 19 (High-Velocity Hurricane Zones) of this code and having a minimum 2-in. (51 mm) thickness.
5. Roof systems constructed in accordance with Chapter 22 or Chapter 23 (High-Velocity Hurricane Zones) of this code, sheathed with a minimum $^{19}/_{32}$-inch (15 mm) CD exposure 1 plywood or minimum nominal 1-inch (25 mm) wood decking and surfaced with an approved roof system installed in accordance with Chapter 15 of this code.

All connectors shall be specified by the building designer of record for all loads except impact.

CHAPTER 17
STRUCTURAL TESTS AND SPECIAL INSPECTIONS

SECTION 1701
GENERAL

1701.1 Scope. The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

1701.2 New materials. New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

1701.3 Used materials. The use of second-hand materials that meet the minimum requirements of this code for new materials shall be permitted.

SECTION 1702
DEFINITIONS

1702.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

APPROVED AGENCY. An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.

APPROVED FABRICATOR. An established and qualified person, firm or corporation approved by the building official pursuant to Chapter 17 of this code.

CERTIFICATE OF COMPLIANCE. A certificate stating that materials and products meet specified standards or that work was done in compliance with approved construction documents.

DESIGNATED SEISMIC SYSTEM. Reserved.

FABRICATED ITEM. Structural, load-bearing or lateral load-resisting assemblies consisting of materials assembled prior to installation in a building or structure or subjected to operations such as heat treatment, thermal cutting, cold working or reforming after manufacture and prior to installation in a building or structure. Materials produced in accordance with standard specifications referenced by this code, such as rolled structural steel shapes, steel-reinforcing bars, masonry units and wood structural panels shall not be considered "fabricated items."

GARAGE DOOR MANUFACTURER. The party responsible for the completed assembly of the garage door components.

INSPECTION CERTIFICATE. An identification applied on a product by an approved agency containing the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the product or material has been inspected and evaluated by an approved agency (see Section 1703.5 and "Label," "Manufacturer's designation" and "Mark").

LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency (see Section 1703.5 and "Inspection certificate," "Manufacturer's designation" and "Mark").

MAIN WIND-FORCE-RESISTING SYSTEM. An assemblage of structural elements assigned to provide support and stability for the overall structure. The system generally receives wind loading from more than one surface.

MANUFACTURER'S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see also "Inspection certificate," "Label" and "Mark").

MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see also "Inspection certificate," "Label" and "Manufacturer's designation").

PERMANENT LABEL. A label that cannot be removed without noticeable damange.

SPECIAL INSPECTION. Reserved.

SPECIAL INSPECTION, CONTINUOUS. Reserved.

SPECIAL INSPECTION, PERIODIC. Reserved.

SPRAYED FIRE-RESISTANT MATERIALS. Cementitious or fibrous materials that are spray applied to provide fire-resistant protection of the substrates.

STRUCTURAL OBSERVATION. Reserved.

SECTION 1703
APPROVALS

1703.1 Approved agency. An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements.

1703.1.1 Independent. An approved agency shall be objective and competent. The agency shall also disclose possible conflicts of interest so that objectivity can be confirmed.

1703.1.2 Equipment. An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

1703.1.3 Personnel. An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.

1703.2 Written approval. Any material, appliance, equipment, system or method of construction meeting the require-

ments of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.

1703.3 Approved record. For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be open to public inspection at appropriate times.

1703.4 Performance. Specific information consisting of test reports conducted by an approved testing agency in accordance with standards referenced in Chapter 35, or other such information as necessary, shall be provided for the building official to determine that the material meets the applicable code requirements.

1703.4.1 Research and investigation. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the permit applicant.

1703.4.2 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

1703.5 Labeling. Where materials or assemblies are required by this code to be labeled, such materials and assemblies shall be labeled by an approved agency in accordance with Section 1703. Products and materials required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703.5.1 through 1703.5.3.

1703.5.1 Testing. An approved agency shall test a representative sample of the product or material being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

1703.5.2 Inspection and identification. The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product or material is representative of the product or material tested.

1703.5.3 Label information. The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or material's performance characteristics and approved agency's identification.

1703.6 Heretofore approved materials. The use of any material already fabricated or of any construction already erected, which conformed to requirements or approvals heretofore in effect, shall be permitted to continue, if not detrimental to life, health or safety to the public.

1703.7 Evaluation and follow-up inspection services. Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the permit applicant shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

1703.7.1 Follow-up inspection. Reserved.

1703.7.2 Test and inspection records. Copies of necessary test and inspection records shall be filed with the building official.

SECTION 1704
SPECIAL INSPECTIONS
RESERVED

SECTION 1705
QUALITY ASSURANCE FOR SEISMIC RESISTANCE
RESERVED

SECTION 1706
QUALITY ASSURANCE FOR WIND RESISTANCE
RESERVED

SECTION 1707
SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE
RESERVED

SECTION 1708
STRUCTURAL TESTING FOR SEISMIC RESISTANCE
RESERVED

SECTION 1709
STRUCTURAL OBSERVATIONS
RESERVED

SECTION 1710
DESIGN STRENGTHS OF MATERIALS

1710.1 Conformance to standards. The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

1710.2 New materials. For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1711.

SECTION 1711
ALTERNATIVE TEST PROCEDURE

1711.1 General. In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.11. The cost of all tests and other investigations required under the provisions of this code shall be borne by the permit applicant.

SECTION 1712
TEST SAFE LOAD

1712.1 Where required. Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1714. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

SECTION 1713
IN-SITU LOAD TESTS

1713.1 General. Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. If the structural assessment determines that the load-bearing capacity is less than that required by the code, load tests shall be conducted in accordance with Section 1713.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

1713.2 Test standards. Structural components and assemblies shall be tested in accordance with the appropriate material standards listed in Chapter 35. In the absence of a standard that contains an applicable load test procedure, the test procedure shall be developed by a registered design professional and approved. The test procedure shall simulate loads and conditions of application that the completed structure or portion thereof will be subjected to in normal use.

1713.3 In-situ load tests. In-situ load tests shall be conducted in accordance with Section 1713.3.1 or 1713.3.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

1713.3.1 Load test procedure specified. Where a standard listed in Chapter 35 contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1713.3.2 shall apply.

1713.3.2 Load test procedure not specified. In the absence of applicable load test procedures contained within a standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic-load-resisting system, the test load shall be equal to two times the unfactored design loads. The test load shall be left in place for a period of 24 hours. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604.3. The HVHZ shall comply with Section 1613.1.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

SECTION 1714
PRECONSTRUCTION LOAD TESTS

1714.1 General. In evaluating the physical properties of materials and methods of construction that are not capable of being designed by approved engineering analysis or do not comply with applicable material design standards listed in Chapter 35, the structural adequacy shall be predetermined based on the load test criteria established in this section.

1714.2 Load test procedures specified. Where specific load test procedures, load factors and acceptance criteria are included in the applicable design standards listed in Chapter 35, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1714.3 shall apply.

1714.3 Load test procedures not specified. Where load test procedures are not specified in the applicable design standards listed in Chapter 35, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that

are not a part of the seismic-load-resisting system, the test shall be as specified in Section 1714.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

1714.3.1 Test procedure. The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1714.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1714.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the lesser of:

1. The load at the deflection limitation given in Section 1714.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

1714.3.2 Deflection. The deflection of structural members under the design load shall not exceed the limitations in Section 1604.3. The HVHZ shall comply with Section 1613.1.

1714.4 Wall and partition assemblies. Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

1714.5 Exterior window and door assemblies. This section defines performance and construction requirements for exterior window and door assemblies installed in wall systems. Waterproofing, sealing and flashing systems are not included in the scope of this section.

1714.5.1 The design pressure for window and door assemblies shall be calculated in accordance with component and cladding wind loads in Section 1609.

1714.5.2 Exterior windows, sliding and patio glass doors.

1714.5.2.1 Testing and labeling. Exterior windows and glass doors shall be tested by an approved independent testing laboratory, and shall be labeled with an approved label identifying the manufacturer, performance characteristics and approved product certification agency, testing laboratory, evaluation entity or Miami-Dade Product Approval to indicate compliance with the requirements of one of the following specifications:

ANSI/AAMA/NWWDA 101/I.S. 2 or 101/I.S. 2/NAFS or AAMA/WDMA/CSA 101/I.S. 2/A440 or TAS 202 (HVHZ shall comply with TAS 202 utilizing ASTM E 1300-98 or ASTM E 1300-02 or Section 2404).

Exceptions:

1. Door assemblies installed in nonhabitable areas where the door assembly and area are designed to accept water infiltration need not be tested for water infiltration.
2. Door assemblies installed where the overhang (OH) ratio is equal to or more than 1 need not be tested for water infiltration. The overhang ratio shall be calculated by the following equation:

   OH ratio = OH Length/OH Height

   Where:

   OH length = The horizontal measure of how far an overhang over a door projects out from door surface.

   OH height = The vertical measure of the distance from the door sill to the bottom of the overhang over a door.
3. Pass-through windows for serving from a single-family kitchen, where protected by a roof overhang of 5 feet (1.5 m) or more shall be exempted from the requirements of the water infiltration test.

The permanent label is limited to only one design pressure rating per reference standard per label.

Exterior windows and glass doors shall be labeled with a temporary supplemental label printed and applied by the manufacturer. The label shall identify the manufacturer, products model/series number, positive and negative design pressure rating, products maximum size, glazing thickness, indicate impact rated if applicable, Florida Product Approval or Miami-Dade Product Approval number if applicable, and applicable test standard. The supplemental label is limited to only one design pressure rating per reference standard per label. This supplemental label shall remain on the window until final approval by the building official.

The permanent label shall always be the default label in case the temporary label is missing or no longer legible for final approval by the building official.

Glass Strength: Products tested and labeled as conforming to ANSI/AAMA/NWWDA 101/I.S. 2 or 101/I.S. 2/NAFS or AAMA/WDMA/CSA 101/I.S. 2/A440 or TAS 202 shall not be subject to the requirements of Sections 2403.2 or 2403.3 or 2404.1. Determination of load resistance of glass for specific loads of products not tested and certified in accordance with Section 1714.5.2.1 shall be designed and labeled to comply with ASTM E 1300 in accordance with Section 2404. The supplemental label shall designate the type and thickness of glass or glazing material.

1714.5.2.1.1 Testing and labeling of skylights. Exterior skylights shall be tested by an approved independent testing laboratory, and shall be labeled with an approved permanent label identifying the

manufacturer, the products model/series number, performance characteristics and approved product evaluation entity to indicate compliance with the requirements of the following specification:

AAMA/WDMA 101/I.S.2/NAFS, Voluntary Performance Specification for Windows, Skylights and Glass Doors, or TAS 202 (HVHZ shall comply with TAS 202).

The permanent label is limited to only one design pressure rating per reference standard per label.

Exterior skylights shall be labeled with a temporary supplemental label printed and applied by the manufacturer. The label shall identify the manufacturer, products model/series number, positive and negative design pressure rating, products maximum size, glazing thickness, indicate impact rated if applicable, Florida Product Approval or Miami-Dade Product Approval number if applicable, and applicable test standard. The supplemental label is limited to only one design pressure rating per reference standard per label. This supplemental label shall remain on the window until final approval by the building official. The permanent label shall always be the default label in case the temporary label is missing or no longer legible for final approval by the building official.

1714.5.2.2 Supplemental label. A temporary supplemental label conforming to AAMA 203, Procedural Guide for the Window Inspection and Notification System, shall be acceptable for establishing calculated allowable design pressures higher than indicated on the label required by Section 1714.5.2.1 for window sizes smaller than that required by the ANSI/AAMA/NWWDA 101/I.S.2 or 101/I.S. 2/NAFS or AAMA/WDMA/CSA 101/I.S.2/A440 test requirements. This supplemental label shall remain on the window until final approval by the building official.

Exception 1:

Comparative analysis of operative windows and glazed doors may be made, provided the proposed unit complies with the following:

1. Shall always be compared with a tested and currently approved unit.
2. Varies only in width, height and/or load requirements.
3. Shall not exceed 100 percent of the proportional deflection for fiber stress of the intermediate members of the approved unit.
4. Shall conform as to extruded members, reinforcement and in all other ways with the tested approved unit.
5. Shall not exceed 100 percent of the concentrated load at the juncture of the intermediate members and the frame of the approved unit.
6. Shall not permit more air and water infiltration than the approved unit based on the height above grade.
7. Compared unit shall not exceed the maximum cyclic pressure when tested per TAS 203 or ASTM E 1886 and ASTM E 1996.

Exception 2 :

Comparative analysis of fixed glass windows may be made provided the proposed unit complies with the following:

1. Shall always be compared with a tested and currently approved unit.
2. Varies only in width, height and/or load requirements.
3. The design is identical in all respects. e.g., extrusions, glazing system, joinery, fasteners, etc.
4. Shall not permit more air and water infiltration than the approved unit based on height above grade.
5. The maximum uniform load distribution (ULD) of any side is equal to the uniform load carried by the side divided by the length of the side.
6. The ULD of any member must not exceed the ULD of the corresponding member of the tested window.
7. The uniform load distribution on each member shall be calculated in accordance to Section 2, Engineering Design Rules, of the AAMA 103.3 Procedural Guide.
8. Compared unit shall not exceed the maximum cyclic pressure when tested per TAS 201,TAS 202 and TAS 203 or ASTM E 1886 and ASTM E 1996.

1714.5.3 Exterior door assemblies. Exterior door assemblies not covered by Section 1714.4.2 or Section 1714.5.3.1 shall be tested for structural integrity in accordance with ASTM E 330 Procedure A, at a load of 1.5 times the required design pressure load. The load shall be sustained for 10 seconds with no permanent deformation of any main frame or panel member in excess of 0.4 percent of its span after the load is removed. High-velocity hurricane zones shall comply with TAS 202. After each specified loading, there shall be no glass breakage, permanent damage to fasteners, hardware parts, or any other damage which causes the door to be inoperable.

The minimum test sizes and minimum design pressures shall be as indicated in Table 1714.5.3.

The unit size tested shall qualify all units smaller in width and/or height of the same operation type and be limited to cases where frame, panels and structural members maintain the same profile as tested.

TABLE 1714.5.3
MINIMUM TEST SIZES, INCLUDING FRAMING

PERFORMANCE CLASS[1]	WIDTH X HEIGHT (mm)	WIDTH X HEIGHT (IN.)	MINIMUM PERFORMANCE GRADE (DESIGN PRESSURE)
Residential (R)	900 x 2000	(36 x 79)	720 Pa (15 psf)
Light Commercial (LC)	900 x 2100	(36 x 83)	1200 Pa (25 psf)
Commercial (C)	1000 x 2100	(40 x 83)	1440 Pa (25 psf)
Heavy Commercial (HC)	1200 x 2400	(48 x 95)	1920 Pa (40 psf)
Architectural (AW)	1200 x 2400	(48 x 95)	1920 Pa (40 psf)

1. Performance Class and Performance Grade per ANSI/AAMA/NWWDA 101/I.S.2.

1714.5.3.1 Sectional garage doors and rolling doors shall be tested for determination of structural performance under uniform static air pressure difference in accordance with ANSI/DASMA 108, ASTM E 330 Procedure A, or TAS 202. For products tested in accordance with ASTM E 330, testing shall include a load of 1.5 times the required design pressure load sustained for 10 seconds, and acceptance criteria shall be in accordance with ANSI/DASMA 108 (HVHZ shall comply with TAS 202).

1714.5.3.2 Custom doors. Custom (one of a kind) exterior door assemblies shall be tested by an approved testing laboratory or be engineered in accordance with accepted engineering practices.

1714.5.3.3 Door components evaluated by an approved product evaluation entity, certification agency, testing laboratory or engineer may be interchangeable in exterior door assemblies provided that the door component(s) provide equal or greater structural performance as demonstrated by accepted engineering practices.

1714.5.3.3.1 Glazed curtain wall, window wall and storefront systems shall be tested in accordance with the requirements of this section and the Laboratory Test requirements of the American Architectural Manufacturers Association (AAMA) Standard 501; HVHZ shall comply with Section 2411.3.2.1.1.

Exceptions:

1. Door assemblies installed in nonhabitable areas where the door assembly and area are designed to accept water infiltration need not be tested for water infiltration.
2. Door assemblies installed where the overhang (OH) ratio is equal to or more than 1 need not be tested for water infiltration. The overhang ratio shall be calculated by the following equation:

OH ratio = OH Length/OH Height

where:

OH Length = The horizontal measure of how far an overhang over a door projects out from door surface.

OH Height = The vertical measure of the distance from the door sill to the bottom of the overhang over a door.

1714.5.3.3.2 Optional exterior door component testing. With the exception of HVHZ, exterior side-hinged door assemblies not covered by Section 1714.5.2 shall have the option to have the components of the assembly tested and rated for structural integrity in accordance with the following specification:

SDI A250.13

Following the structural testing of exterior door components, there shall be no permanent deformation of any perimeter frame or panel member in excess of 0.4 percent of its span after the load is removed. After each specified loading, there shall be no glass breakage, permanent damage to fasteners, hardware parts, or any other damage that causes the door to be inoperable, as applicable.

1714.5.3.4 Garage door labeling. Garage doors shall be labeled with a permanent label provided by the manufacturer. The label shall identify the manufacturer, the garage door model/series number, the positive and negative design pressure rating, indicate impact rated if applicable, the installation instruction drawing reference number, the Florida Product Approval or Miami-Dade Product Approval number if applicable, and the applicable test standards.

The required garage door components for an approved garage door assembly may be indicated using a checklist format on the label. If a checklist format is used on the label, the installer or manufacturer shall mark the selected components on the checklist that are required to assemble an approved garage door system.

The installation instructions shall be provided and available on the job site.

1714.5.4 Anchorage methods. The methods cited in this section apply only to anchorage of window and door assemblies to the main wind force resisting system.

1714.5.4.1 Anchoring requirements. Window and door assemblies shall be anchored in accordance with the published manufacturer's recommendations to achieve the design pressure specified. Substitute anchoring systems used for substrates not specified by the fenestration manufacturer shall provide equal or greater anchoring performance as demonstrated by accepted engineering practice.

1714.5.4.2 Masonry, concrete or other structural substrate. Where the wood shim or buck thickness is less than $1\frac{1}{2}$ inches (38 mm), window and door assemblies shall be anchored through the main frame or by jamb clip

or subframe system, in accordance with the manufacturer's published installation instructions. Anchors shall be securely fastened directly into the masonry, concrete or other structural substrate material. Unless otherwise tested, bucks shall extend beyond the interior face of the window or door frame such that full support of the frame is provided. Shims shall be made from materials capable of sustaining applicable loads, located and applied in a thickness capable of sustaining applicable loads. Anchors shall be provided to transfer load from the window or door frame to the rough opening substrate.

Where the wood buck thickness is $1^1/_4$ inches (38 mm) or greater, the buck shall be securely fastened to transfer load to the masonry, concrete or other structural subtrate and the buck shall extend beyond the interior face of the window or door frame. Window and door assemblies shall be anchored through the main frame or by jamb clip or subframe system or through the flange to the secured wood buck in accordance with the manufacturer's published installation instructions. Unless otherwise tested, bucks shall extend beyond the interior face of the window or door frame such that full support of the frame is provided. Shims shall be made from materials capable of sustaining applicable loads, located and applied in a thickness capable of sustaining applicable loads. Anchors shall be provided to transfer load from the window or door frame assembly to the secured wood buck.

1714.5.4.3 Wood or other approved framing materials. Where the framing material is wood or other approved framing material, window and glass door assemblies shall be anchored through the main frame or by jamb clip or subframe system or through the flange in accordance with the manufacturer's published installation instructions. Shims shall be made from materials capable of sustaining applicable loads, located and applied in a thickness capable of sustaining applicable loads. Anchors shall be provided to transfer load from the window or door frame to the rough opening substrate.

1714.5.5 Mullions occurring between individual window and glass door assemblies.

1714.5.5.1 Mullions. Mullions or mulled fenestration assemblies shall be tested by an approved testing laboratory in accordance with either AAMA 450, ASTM E 330, or TAS 202 (HVHZ shall comply with TAS 202), or shall be engineered in accordance with AAMA 450 using accepted engineering practice. Mullions tested as stand-alone units or qualified by engineering shall use performance criteria cited in Sections 1714.5.5.2, 1714.5.5.3 and 1714.5.5.4. Mullions qualified by an actual test of an entire assembly shall comply with Section 1714.5.5.4, except that mullions in assemblies requiring a deflection limitation, as defined in AAMA/WDMA/CSA 101/I.S.2/A440, shall meet Sections 1714.5.5.2 and 1714.5.5.3. Products not included within the scope of Section 1714.5.5.1 shall comply with Sections 1714.5.5.3 and 1714.5.5.4.

1714.5.5.2 Load transfer. Mullions shall be designed to transfer the design pressure loads applied by the window and door assemblies to the rough opening substrate.

1714.5.5.3 Deflection. Mullions shall be capable of resisting the design pressure loads applied by the window and door assemblies to be supported without deflecting more than L/175, where L is the span of the mullion in inches.

1714.5.5.4 Structural safety factor. Mullions that are tested by an approved testing laboratory shall be capable of resisting a load of 1.5 times the design pressure loads applied by the window and door assemblies to be supported. The 1.5 times the design pressure load shall be sustained for 10 seconds, and the permanent deformation shall not exceed 0.2 percent of the mullion span for assemblies requiring deflection limitations, as defined in AAMA/WDMA/CSA 101/I.S.2/A440 and 0.4 percent of the mullion span for all other assemblies after the 1.5 times design pressure load is removed. Mullions that are qualified by engineering shall be capable of resisting the design pressure loads applied by the window and door assemblies to be supported without exceeding the allowable stress of the mullion elements.

1714.6 Test specimens. Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples (when TAS 202 is used, a minimum of three specimens) of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

1714.7 Installation instruction for exterior windows and doors. Windows and doors shall be installed in accordance with the manufacturer's installation instruction.

1714.8 Impact-resistant coverings.

1714.8.1 Labels. A permanent label shall be provided by the product approval holder on all impact-resistant coverings.

1714.8.2 The following information shall be included on the labels on impact-resistant coverings:

1. Product approval holder name and address.
2. All applicable methods of approval. Methods of approval include, but are not limited to Miami-Dade NOA; Florida Building Commission, TDI Product Evaluation; ICC-ES.
3. The test standard or standards specified at Section 1609.1.2, including standards referenced within the test standards specified at Section 1609.1.2 used to demonstrate code compliance.
4. For products with a Florida Product Approval Number or a Miami-Dade County Building Code Compliance Office Notice of Acceptance Number (NOA), such numbers shall be included on the label.

1714.8.3 Location of label. The location of the label on the impact-resistant covering shall be as follows:

1. Accordions: Bottom of the locking bar or center mate facing the exterior or outside.
2. Rollup: On the bottom of the hood facing the exterior or outside or on the bottom slat facing the exterior or outside.
3. Bahama Awning or Colonial Hinged: On the bottom, placed on the back of the shutter.
4. Panels: For metal and plastic panels the label may be embossed or printed spaced not more than every three (3) lineal feet on each panel. The label shall be applied by the holder of the product approval and shall face the exterior or outside.
5. Framed products: The label shall be on the side or bottom facing the exterior or outside.
6. Labels on all other products shall face the exterior or outside.

1714.8.4 Installation. All impact-resistant coverings shall be installed in accordance with the manufacturer's installation instructions and in accordance with the product approval. Installation instructions shall be provided and shall be available to inspection personnel on the job site. Opening protection components, fasteners, and other parts evaluated by an approved product evaluation entity, certification agency, testing laboratory, architect, or engineer and approved by the holder of the product approval may be interchangeable in opening protection assemblies provided that the opening protection component(s) provide equal or greater structural performance and durability as demonstrated by testing in accordance with approved test standards.

SECTION 1715
MATERIAL AND TEST STANDARDS

1715.1 Test standards for joist hangers and connectors.

1715.1.1 Test standards for joist hangers. The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with ASTM D 1761 using lumber having a specific gravity of 0.49 or greater, but not greater than 0.55, as determined in accordance with AF&PA NDS for the joist and headers.

Exception: The joist length shall not be required to exceed 24 inches (610 mm).

1715.1.2 Vertical load capacity for joist hangers. The vertical load capacity for the joist hanger shall be determined by testing a minimum of three joist hanger assemblies as specified in ASTM D 1761. If the ultimate vertical load for any one of the tests varies more than 20 percent from the average ultimate vertical load, at least three additional tests shall be conducted. The allowable vertical load of the joist hanger shall be the lowest value determined from the following:

1. The lowest ultimate vertical load for a single hanger from any test divided by three (where three tests are conducted and each ultimate vertical load does not vary more than 20 percent from the average ultimate vertical load).
2. The average ultimate vertical load for a single hanger from all tests divided by three (where six or more tests are conducted).
3. The average from all tests of the vertical loads that produce a vertical movement of the joist with respect to the header of 0.125 inch (3.2 mm).
4. The sum of the allowable design loads for nails or other fasteners utilized to secure the joist hanger to the wood members and allowable bearing loads that contribute to the capacity of the hanger.
5. The allowable design load for the wood members forming the connection.

1715.1.3 Torsional moment capacity for joist hangers. The torsional moment capacity for the joist hanger shall be determined by testing at least three joist hanger assemblies as specified in ASTM D 1761. The allowable torsional moment of the joist hanger shall be the average torsional moment at which the lateral movement of the top or bottom of the joist with respect to the original position of the joist is 0.125 inch (3.2 mm).

1715.1.4 Design value modifications for joist hangers. Allowable design values for joist hangers that are determined by Item 4 or 5 in Section 1715.1.2 shall be permitted to be modified by the appropriate duration of loading factors as specified in AF&PA NDS but shall not exceed the direct loads as determined by Item 1, 2 or 3 in Section 1715.1.2. Allowable design values determined by Item 1, 2 or 3 in Section 1715.1.2 and 2305.1 shall not be modified by duration of loading factors.

1715.2 Concrete and clay roof tiles.

1715.2.1 Overturning resistance. Concrete and clay roof tiles shall be tested to determine their resistance to overturning due to wind in accordance with SBCCI SSTD 11 or TAS 108 (high-velocity hurricane zones shall comply with TAS 108) and Chapter 15.

1715.2.2 Wind tunnel testing. When roof tiles do not satisfy the limitations in Chapter 16 for rigid tile, a wind tunnel test shall be used to determine the wind characteristics of the concrete or clay tile roof covering in accordance with SBCCI SSTD 11 or TAS 108 (high-velocity hurricane zones shall comply with TAS 108) and Chapter 15.

CHAPTER 18
SOILS AND FOUNDATIONS

SECTION 1801
GENERAL

1801.1 Scope. The provisions of this chapter shall apply to building and foundation systems in those areas not subject to scour or water pressure by wind and wave action. Buildings and foundations subject to such scour or water pressure loads shall be designed in accordance with Chapter 16.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 1816 through 1834.

1801.2 Design. Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in Section 1605.3. The quality and design of materials used structurally in excavations, footings and foundations shall conform to the requirements specified in Chapters 16, 19, 21, 22 and 23 of this code. Excavations and fills shall also comply with Chapter 33.

1801.2.1 Foundation design for seismic overturning. Reserved.

SECTION 1802
FOUNDATION AND SOILS INVESTIGATIONS

1802.1 General. Foundation and soils investigations shall be conducted in conformance with Sections 1802.2 through 1802.6. Where required by the building official, the classification and investigation of the soil shall be made by a registered design professional.

1802.2 Where required. The owner or applicant shall submit a foundation and soils investigation to the building official where required in Sections 1802.2.1 through 1802.2.7.

Exception: The building official need not require a foundation or soils investigation where satisfactory data from adjacent areas is available that demonstrates an investigation is not necessary for any of the conditions in Sections 1802.2.1 through 1802.2.6.

1802.2.1 Questionable soil. Where the classification, strength or compressibility of the soil are in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall require that the necessary investigation be made. Such investigation shall comply with the provisions of Sections 1802.4 through 1802.6.

1802.2.2 Expansive soils. In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

1802.2.3 Ground-water table. A subsurface soil investigation shall be performed to determine whether the existing ground-water table is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.

Exception: A subsurface soil investigation shall not be required where waterproofing is provided in accordance with Section 1807.

1802.2.4 Pile and pier foundations. Pile and pier foundations shall be designed and installed on the basis of a foundation investigation and report as specified in Sections 1802.4 through 1802.6 and Section 1808.2.2.

1802.2.5 Rock strata. Where subsurface explorations at the project site indicate variations or doubtful characteristics in the structure of the rock upon which foundations are to be constructed, a sufficient number of borings shall be made to a depth of not less than 10 feet (3048 mm) below the level of the foundations to provide assurance of the soundness of the foundation bed and its load-bearing capacity.

1802.2.6 Seismic Design Category C. Reserved.

1802.2.7 Seismic Design Category D, E or F. Reserved.

1802.3 Soil classification. Where required, soils shall be classified in accordance with Section 1802.3.1 or 1802.3.2.

1802.3.1 General. For the purposes of this chapter, the definition and classification of soil materials for use in Table 1804.2 shall be in accordance with ASTM D 2487.

1802.3.2 Expansive soils. Soils meeting all four of the following provisions shall be considered expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D 4318.
2. More than 10 percent of the soil particles pass a No. 200 sieve (75 μm), determined in accordance with ASTM D 422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D 422.
4. Expansion index greater than 20, determined in accordance with ASTM D 4829.

1802.4 Investigation. Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

1802.4.1 Exploratory boring. The scope of the soil investigation including the number and types of borings or soundings, the equipment used to drill and sample, the

in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

1802.5 Soil boring and sampling. The soil boring and sampling procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on the site during all boring and sampling operations.

1802.6 Reports. The soil classification and design load-bearing capacity shall be shown on the construction documents. Where required by the building official, a written report of the investigation shall be submitted that includes, but need not be limited to, the following information:

1. A plot showing the location of test borings and/or excavations.
2. A complete record of the soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered.
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads.
6. Expected total and differential settlement.
7. Pile and pier foundation information in accordance with Section 1808.2.2.
8. Special design and construction provisions for footings or foundations founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section 1803.5.

SECTION 1803
EXCAVATION, GRADING AND FILL

1803.1 Excavations near footings or foundations. Excavations for any purpose shall not remove lateral support from any footing or foundation without first underpinning or protecting the footing or foundation against settlement or lateral translation.

1803.2 Placement of backfill. The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or a controlled low-strength material (CLSM). The backfill shall be placed in lifts and compacted, in a manner that does not damage the foundation or the waterproofing or dampproofing material.

Exception: Controlled low-strength material need not be compacted.

1803.3 Site grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than one unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped a minimum of 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped a minimum of 2 percent away from the building.

Exception: Where climatic or soil conditions warrant, the slope of the ground away from the building foundation is permitted to be reduced to not less than one unit vertical in 48 units horizontal (2-percent slope).

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

1803.4 Grading and fill in flood hazard areas. See Section 3110.

1803.5 Compacted fill material. Where footings will bear on compacted fill material, the compacted fill shall comply with the provisions of an approved report, which shall contain the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test method to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

Exception: Compacted fill material less than 12 inches (305 mm) in depth need not comply with an approved report, provided it has been compacted to a minimum of 90 percent Modified Proctor in accordance with ASTM D 1557. The compaction shall be verified by a qualified inspector approved by the building official.

1803.6 Controlled low-strength material (CLSM). Where footings will bear on controlled low-strength material (CLSM), the CLSM shall comply with the provisions of an approved report, which shall contain the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.
4. Test methods for determining the acceptance of the CLSM in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

SECTION 1804
ALLOWABLE LOAD-BEARING VALUES OF SOILS

1804.1 Design. The presumptive load-bearing values provided in Table 1804.2 shall be used with the allowable stress design load combinations specified in Section 1605.3.

1804.2 Presumptive load-bearing values. The maximum allowable foundation pressure, lateral pressure or lateral sliding-resistance values for supporting soils near the surface shall not exceed the values specified in Table 1804.2 unless data to substantiate the use of a higher value are submitted and approved.

Presumptive load-bearing values shall apply to materials with similar physical characteristics and dispositions.

Mud, organic silt, organic clays, peat or unprepared fill shall not be assumed to have a presumptive load-bearing capacity unless data to substantiate the use of such a value are submitted.

Exception: A presumptive load-bearing capacity is permitted to be used where the building official deems the load-bearing capacity of mud, organic silt or unprepared fill is adequate for the support of lightweight and temporary structures.

1804.3 Lateral sliding resistance. The resistance of structural walls to lateral sliding shall be calculated by combining the values derived from the lateral bearing and the lateral sliding resistance shown in Table 1804.2 unless data to substantiate the use of higher values are submitted for approval.

For clay, sandy clay, silty clay and clayey silt, in no case shall the lateral sliding resistance exceed one-half the dead load.

1804.3.1 Increases in allowable lateral sliding resistance. The resistance values derived from the table are permitted to be increased by the tabular value for each additional foot (305 mm) of depth to a maximum of 15 times the tabular value.

Isolated poles for uses such as flagpoles or signs and poles used to support buildings that are not adversely affected by a 0.5 inch (12.7 mm) motion at the ground surface due to short-term lateral loads are permitted to be designed using lateral-bearing values equal to two times the tabular values.

SECTION 1805
FOOTINGS AND FOUNDATIONS

1805.1 General. Footings and foundations shall be designed and constructed in accordance with Sections 1805.1 through 1805.9. Footings and foundations shall be built on undisturbed soil, compacted fill material or CLSM. Compacted fill material shall be placed in accordance with Section 1803.5. CLSM shall be placed in accordance with Section 1803.6.

The top surface of footings shall be level. The bottom surface of footings is permitted to have a slope not exceeding one unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than one unit vertical in 10 units horizontal (10-percent slope).

1805.2 Depth of footings. The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the depth of footings shall also conform to Sections 1805.2.1 through 1805.2.3.

1805.2.1 Frost protection. Except where otherwise protected from frost, foundation walls, piers and other permanent supports of buildings and structures shall be protected by one or more of the following methods:

1. Extending below the frost line of the locality;
2. Constructing in accordance with ASCE 32; or
3. Erecting on solid rock.

Exception: Free-standing buildings meeting all of the following conditions shall not be required to be protected:

TABLE 1804.2
ALLOWABLE FOUNDATION AND LATERAL PRESSURE

CLASS OF MATERIALS	ALLOWABLE FOUNDATION PRESSURE (psf)[d]	LATERAL BEARING (psf/f below natural grade)[d]	LATERAL SLIDING	
			Coefficient of friction[a]	Resistance (psf)[b]
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and/or gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500[c]	100	—	130

For SI: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Lateral sliding resistance value to be multiplied by the contact area, as limited by Section 1804.3.

c. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf (72 kPa) are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

d. An increase of one-third is permitted when using the alternate load combinations in Section 1605.3.2 that include wind loads.

1. Classified in Occupancy Category I, in accordance with Section1604.5;
2. Area of 600 square feet (56 m^2) or less for light-frame construction or 400 square feet (37 m^2) or less for other than light-frame construction; and
3. Eave height of 10 feet (3048 mm) or less.

Footings shall not bear on frozen soil unless such frozen condition is of a permanent character.

1805.2.2 Isolated footings. Footings on granular soil shall be so located that the line drawn between the lower edges of adjoining footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

1805.2.3 Shifting or moving soils. Where it is known that the shallow subsoils are of a shifting or moving character, footings shall be carried to a sufficient depth to ensure stability.

1805.3 Footings on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall conform to Sections 1805.3.1 through 1805.3.5.

1805.3.1 Building clearance from ascending slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided for in Section 1805.3.5 and Figure 1805.3.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

1805.3.2 Footing setback from descending slope surface. Footings on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement. Except as provided for in Section 1805.3.5 and Figure 1805.3.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

1805.3.3 Pools. The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet (2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.

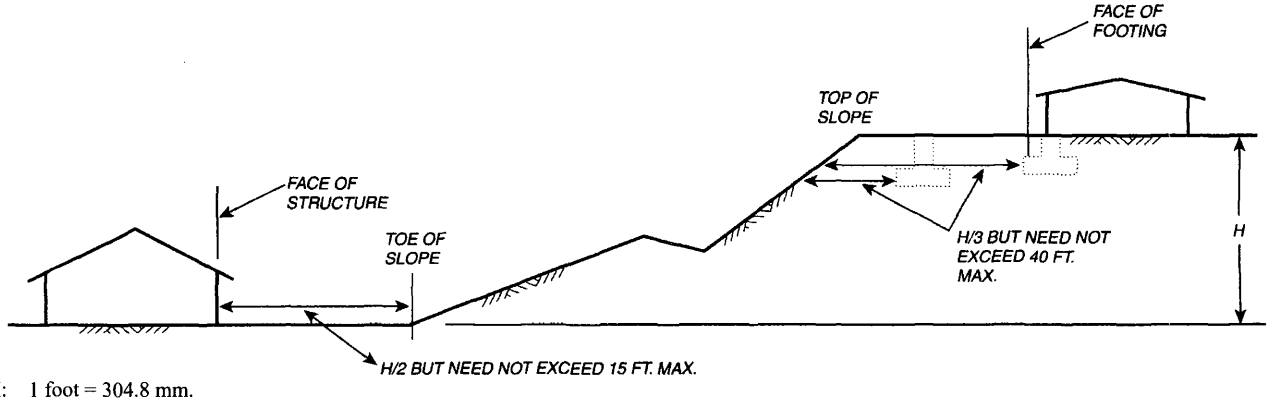
1805.3.4 Foundation elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device a minimum of 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

1805.3.5 Alternate setback and clearance. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official is permitted to require an investigation and recommendation of a registered design professional to demonstrate that the intent of this section has been satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

1805.4 Footings. Footings shall be designed and constructed in accordance with Sections 1805.4.1 through 1805.4.6.

1805.4.1 Design. Footings shall be so designed that the allowable bearing capacity of the soil is not exceeded, and that differential settlement is minimized. The minimum width of footings shall be 12 inches (305 mm).

Footings in areas with expansive soils shall be designed in accordance with the provisions of Section 1805.8.



For SI: 1 foot = 304.8 mm.

FIGURE 1805.3.1
FOUNDATION CLEARANCES FROM SLOPES

1805.4.1.1 Design loads. Footings shall be designed for the most unfavorable effects due to the combinations of loads specified in Section 1605.2 or 1605.3. The dead load is permitted to include the weight of foundations, footings and overlying fill. Reduced live loads, as specified in Sections 1607.9 and 1607.11, are permitted to be used in the design of footings.

1805.4.1.2 Vibratory loads. Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the footing design to prevent detrimental disturbances of the soil.

1805.4.2 Concrete footings. The design, materials and construction of concrete footings shall comply with Sections 1805.4.2.1 through 1805.4.2.6 and the provisions of Chapter 19.

Exception: Where a specific design is not provided, concrete footings supporting walls of light-frame construction are permitted to be designed in accordance with Table 1805.4.2.

1805.4.2.1 Concrete strength. Concrete in footings shall have a specified compressive strength (f'_c) of not less than 2,500 pounds per square inch (psi) (17 237 kPa) at 28 days.

1805.4.2.2 Footing seismic ties. Reserved.

1805.4.2.3 Plain concrete footings. The edge thickness of plain concrete footings supporting walls of other than light-frame construction shall not be less than 8 inches (203 mm) where placed on soil.

Exception: For plain concrete footings supporting Group R-3 occupancies, the edge thickness is permitted to be 6 inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.

1805.4.2.4 Placement of concrete. Concrete footings shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water.

1805.4.2.5 Protection of concrete. Concrete footings shall be protected from freezing during depositing and for a period of not less than five days thereafter. Water shall not be allowed to flow through the deposited concrete.

1805.4.2.6 Forming of concrete. Concrete footings are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require forming. Where forming is required, it shall be in accordance with Chapter 6 of ACI 318.

1805.4.3 Masonry-unit footings. The design, materials and construction of masonry-unit footings shall comply with Sections 1805.4.3.1 and 1805.4.3.2, and the provisions of Chapter 21.

Exception: Where a specific design is not provided, masonry-unit footings supporting walls of light-frame construction are permitted to be designed in accordance with Table 1805.4.2.

1805.4.3.1 Dimensions. Masonry-unit footings shall be laid in Type M or S mortar complying with Section 2103.8 and the depth shall not be less than twice the projection beyond the wall, pier or column. The width shall not be less than 8 inches (203 mm) wider than the wall supported thereon.

1805.4.3.2 Offsets. The maximum offset of each course in brick foundation walls stepped up from the footings shall be 1.5 inches (38 mm) where laid in single courses, and 3 inches (76 mm) where laid in double courses.

1805.4.4 Steel grillage footings. Grillage footings of structural steel shapes shall be separated with approved steel spacers and be entirely encased in concrete with at least 6 inches (152 mm) on the bottom and at least 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

1805.4.5 Timber footings. Timber footings are permitted for buildings of Type V construction and as otherwise

TABLE 1805.4.2
FOOTINGS SUPPORTING WALLS OF LIGHT-FRAME CONSTRUCTION[a, b, c, d, e]

NUMBER OF FLOORS SUPPORTED BY THE FOOTING[f]	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1	12	6
2	15	6
3	18	8[g]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Depth of footings shall be in accordance with Section 1805.2.

b. The ground under the floor is permitted to be excavated to the elevation of the top of the footing.

c. Interior-stud-bearing walls are permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and footings shall be spaced not more than 6 feet on center.

d. Reserved.

e. For thickness of foundation walls, see Section 1805.5.

f. Footings are permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.

g. Plain concrete footings for Group R-3 occupancies are permitted to be 6 inches thick.

approved by the building official. Such footings shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B). Treated timbers are not required where placed entirely below permanent water level or where used as capping for wood piles that project above the water level over submerged or marsh lands. The compressive stresses perpendicular to the grain in untreated timber footings supported upon treated piles shall not exceed 70 percent of the allowable stresses for the species and grade of timber as specified in the AF&PA NDS.

1805.4.6 Wood foundations. Wood foundation systems shall be designed and installed in accordance with AF&PA Technical Report No. 7. Lumber and plywood shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B and Section 5.2) and shall be identified in accordance with Section 2303.1.8.1.

1805.5 Foundation walls. Concrete and masonry foundation walls shall be designed in accordance with Chapter 19 or 21, respectively. Foundation walls that are laterally supported at the top and bottom and within the parameters of Tables 1805.5(1) through 1805.5(5) are permitted to be designed and constructed in accordance with Sections 1805.5.1 through 1805.5.5.

1805.5.1 Foundation wall thickness. The minimum thickness of concrete and masonry foundation walls shall comply with Sections 1805.5.1.1 through 1805.5.1.3.

1805.5.1.1 Thickness at top of foundation wall. The thickness of foundation walls shall not be less than the thickness of the wall supported, except that foundation walls of at least 8-inch (203 mm) nominal width are permitted to support brick-veneered frame walls and 10-inch-wide (254 mm) cavity walls provided the requirements of Section 1805.5.1.2 are met. Corbeling of masonry shall be in accordance with Section 2104.2. Where an 8-inch (203 mm) wall is corbeled, the top corbel shall not extend higher than the bottom of the floor framing and shall be a full course of headers at least 6 inches (152 mm) in length or the top course bed joint shall be tied to the vertical wall projection. The tie shall be W2.8 (4.8 mm) and spaced at a maximum horizontal distance of 36 inches (914 mm); the hollow space behind the corbelled masonry shall be filled with mortar or grout.

1805.5.1.2 Thickness based on soil loads, unbalanced backfill height and wall height. The thickness of foundation walls shall comply with the requirements of Table 1805.5(5) for concrete walls, Table 1805.5(1) for plain masonry walls or Table 1805.5(2), 1805.5(3) or 1805.5(4) for masonry walls with reinforcement. When using the tables, masonry shall be laid in running bond and the mortar shall be Type M or S.

Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill height is permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

1805.5.1.3 Rubble stone. Foundation walls of rough or random rubble stone shall not be less than 16 inches (406 mm) thick. ||

1805.5.2 Foundation wall materials. Concrete foundation walls constructed in accordance with Table 1805.5(5) shall comply with Section 1805.5.2.1. Masonry foundation walls constructed in accordance with Table 1805.5(1), 1805.5(2), 1805.5(3) or 1805.5(4) shall comply with Section 1805.5.2.2.

1805.5.2.1 Concrete foundation walls. Concrete foundation walls shall comply with the following:

1. The size and spacing of vertical reinforcement shown in Table 1805.5(5) is based on the use of reinforcement with a minimum yield strength of 60,000 psi (414 MPa). Vertical reinforcement with a minimum yield strength of 40,000 psi (276 MPa) or 50,000 psi (345 MPa) is permitted, provided the same size bar is used and the spacing shown in the table is reduced by multiplying the spacing by 0.67 or 0.83, respectively.
2. Vertical reinforcement, when required, shall be placed nearest the inside face of the wall a distance, d, from the outside face (soil side) of the wall. The distance, d, is equal to the wall thickness, t, minus 1.25 inches (32 mm) plus one-half the bar diameter, d_b [$d = t - (1.25 + d_b/2)$]. The reinforcement shall be placed within a tolerance of $\pm\,^3/_8$ inch (9.5 mm) where d is less than or equal to 8 inches (203 mm) or $\pm\,^1/_2$ inch (12.7 mm) where d is greater than 8 inches (203 mm).
3. In lieu of the reinforcement shown in Table 1805.5(5), smaller reinforcing bar sizes with closer spacings that provide an equivalent cross-sectional area of reinforcement per unit length of wall are permitted.
4. Concrete cover for reinforcement measured from the inside face of the wall shall not be less than $^3/_4$ inch (19.1 mm). Concrete cover for reinforcement measured from the outside face of the wall shall not be less than 1.5 inches (38 mm) for No. 5 bars and smaller and not less than 2 inches (51 mm) for larger bars.
5. Concrete shall have a specified compressive strength, f_c', of not less than 2,500 psi (17.2 MPa) at 28 days.
6. The unfactored axial load per linear foot of wall shall not exceed $1.2\,tf_c'$, where t is the specified wall thickness in inches.

1805.5.2.2 Masonry foundation walls. Masonry foundation walls shall comply with the following:

TABLE 1805.5(1)
PLAIN MASONRY FOUNDATION WALLS[a, b, c]

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[e] (feet)	MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and Inorganic CL soils 60
7	4 (or less)	8	8	8
	5	8	10	10
	6	10	12	10 (solid[c])
	7	12	10 (solid[c])	10 (solid[c])
8	4 (or less)	8	8	8
	5	8	10	12
	6	10	12	12 (solid[c])
	7	12	12 (solid[c])	Note d
	8	10 (solid[c])	12 (solid[c])	Note d
9	4 (or less)	8	8	8
	5	8	10	12
	6	12	12	12 (solid[c])
	7	12 (solid[c])	12 (solid[c])	Note d
	8	12 (solid[c])	Note d	Note d
	9	Note d	Note d	Note d

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

b. Provisions for this table are based on construction requirements specified in Section 1805.5.2.2.

c. Solid grouted hollow units or solid masonry units.

d. A design in compliance with Chapter 21 or reinforcement in accordance with Table 1805.5(2) is required.

e. For height of unbalanced backfill, see Section 1805.5.1.2.

TABLE 1805.5(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 5 INCHES[a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	VERTICAL REINFORCEMENT		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and Inorganic CL soils 60
7-4	4-0 (or less)	#4 at 48″ o.c.	#4 at 48″ o.c.	#4 at 48″ o.c.
	5-0	#4 at 48″ o.c.	#4 at 48″ o.c.	#4 at 48″ o.c.
	6-0	#4 at 48″ o.c.	#5 at 48″ o.c.	#5 at 48″ o.c.
	7-4	#5 at 48″ o.c.	#6 at 48″ o.c.	#7 at 48″ o.c.
8-0	4-0 (or less)	#4 at 48″ o.c.	#4 at 48″ o.c.	#4 at 48″ o.c.
	5-0	#4 at 48″ o.c.	#4 at 48″ o.c.	#4 at 48″ o.c.
	6-0	#4 at 48″ o.c.	#5 at 48″ o.c.	#5 at 48″ o.c.
	7-0	#5 at 48″ o.c.	#6 at 48″ o.c.	#7 at 48″ o.c.
	8-0	#5 at 48″ o.c.	#6 at 48″ o.c.	#7 at 48″ o.c.
8-8	4-0 (or less)	#4 at 48″ o.c.	#4 at 48″ o.c.	#4 at 48″ o.c.
	5-0	#4 at 48″ o.c.	#4 at 48″ o.c.	#5 at 48″ o.c.
	6-0	#4 at 48″ o.c.	#5 at 48″ o.c.	#6 at 48″ o.c.
	7-0	#5 at 48″ o.c.	#6 at 48″ o.c.	#7 at 48″ o.c.
	8-8	#6 at 48″ o.c.	#7 at 48″ o.c.	#8 at 48″ o.c.
9-4	4-0 (or less)	#4 at 48″ o.c.	#4 at 48″ o.c.	#4 at 48″ o.c.
	5-0	#4 at 48″ o.c.	#4 at 48″ o.c.	#5 at 48″ o.c.
	6-0	#4 at 48″ o.c.	#5 at 48″ o.c.	#6 at 48″ o.c.
	7-0	#5 at 48″ o.c.	#6 at 48″ o.c.	#7 at 48″ o.c.
	8-0	#6 at 48″ o.c.	#7 at 48″ o.c.	#8 at 48″ o.c.
	9-4	#7 at 48″ o.c.	#8 at 48″ o.c.	#9 at 48″ o.c.
10-0	4-0 (or less)	#4 at 48″ o.c.	#4 at 48″ o.c.	#4 at 48″ o.c.
	5-0	#4 at 48″ o.c.	#4 at 48″ o.c.	#5 at 48″ o.c.
	6-0	#4 at 48″ o.c.	#5 at 48″ o.c.	#6 at 48″ o.c.
	7-0	#5 at 48″ o.c.	#6 at 48″ o.c.	#7 at 48″ o.c.
	8-0	#6 at 48″ o.c.	#7 at 48″ o.c.	#8 at 48″ o.c.
	9-0	#7 at 48″ o.c.	#8 at 48″ o.c.	#9 at 48″ o.c.
	10-0	#7 at 48″ o.c.	#9 at 48″ o.c.	#9 at 48″ o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

b. Provisions for this table are based on construction requirements specified in Section 1805.5.2.2.

c. For alternative reinforcement, see Section 1805.5.3.

d. For height of unbalanced backfill, see Section 1805.5.1.2.

TABLE 1805.5(3)
10-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 6.75 INCHES[a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	VERTICAL REINFORCEMENT		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and Inorganic CL soils 60
7-4	4-0 (or less)	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	5-0	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	6-0	#4 at 56″ o.c.	#4 at 56″ o.c.	#5 at 56″ o.c.
	7-4	#4 at 56″ o.c.	#5 at 56″ o.c.	#6 at 56″ o.c.
8-0	4-0 (or less)	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	5-0	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	6-0	#4 at 56″ o.c.	#4 at 56″ o.c.	#5 at 56″ o.c.
	7-0	#4 at 56″ o.c.	#5 at 56″ o.c.	#6 at 56″ o.c.
	8-0	#5 at 56″ o.c.	#6 at 56″ o.c.	#7 at 56″ o.c.
8-8	4-0 (or less)	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	5-0	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	6-0	#4 at 56″ o.c.	#4 at 56″ o.c.	#5 at 56″ o.c.
	7-0	#4 at 56″ o.c.	#5 at 56″ o.c.	#6 at 56″ o.c.
	8-8	#5 at 56″ o.c.	#7 at 56″ o.c.	#8 at 56″ o.c.
9-4	4-0 (or less)	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	5-0	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	6-0	#4 at 56″ o.c.	#5 at 56″ o.c.	#5 at 56″ o.c.
	7-0	#4 at 56″ o.c.	#5 at 56″ o.c.	#6 at 56″ o.c.
	8-0	#5 at 56″ o.c.	#6 at 56″ o.c.	#7 at 56″ o.c.
	9-4	#6 at 56″ o.c.	#7 at 56″ o.c.	#8 at 56″ o.c.
10-0	4-0 (or less)	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	5-0	#4 at 56″ o.c.	#4 at 56″ o.c.	#4 at 56″ o.c.
	6-0	#4 at 56″ o.c.	#5 at 56″ o.c.	#5 at 56″ o.c.
	7-0	#5 at 56″ o.c.	#6 at 56″ o.c.	#7 at 56″ o.c.
	8-0	#5 at 56″ o.c.	#7 at 56″ o.c.	#8 at 56″ o.c.
	9-0	#6 at 56″ o.c.	#7 at 56″ o.c.	#9 at 56″ o.c.
	10-0	#7 at 56″ o.c.	#8 at 56″ o.c.	#9 at 56″ o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

b. Provisions for this table are based on construction requirements specified in Section 1805.5.2.2.

c. For alternative reinforcement, see Section 1805.5.3.

d. For height of unbalanced fill, see Section 1805.5.1.2.

TABLE 1805.5(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 8.75 INCHES[a, b, c]

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT[d] (feet-inches)	VERTICAL REINFORCEMENT		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and Inorganic CL soils 60
7-4	4-0 (or less)	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	5-0	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	6-0	#4 at 72″ o.c.	#4 at 72″ o.c.	#5 at 72″ o.c.
	7-4	#4 at 72″ o.c.	#5 at 72″ o.c.	#6 at 72″ o.c.
8-0	4-0 (or less)	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	5-0	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	6-0	#4 at 72″ o.c.	#4 at 72″ o.c.	#5 at 72″ o.c.
	7-0	#4 at 72″ o.c.	#5 at 72″ o.c.	#6 at 72″ o.c.
	8-0	#5 at 72″ o.c.	#6 at 72″ o.c.	#7 at 72″ o.c.
8-8	4-0 (or less)	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	5-0	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	6-0	#4 at 72″ o.c.	#4 at 72″ o.c.	#5 at 72″ o.c.
	7-0	#4 at 72″ o.c.	#5 at 72″ o.c.	#6 at 72″ o.c.
	8-8	#5 at 72″ o.c.	#7 at 72″ o.c.	#8 at 72″ o.c.
9-4	4-0 (or less)	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	5-0	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	6-0	#4 at 72″ o.c.	#5 at 72″ o.c.	#5 at 72″ o.c.
	7-0	#4 at 72″ o.c.	#5 at 72″ o.c.	#6 at 72″ o.c.
	8-0	#5 at 72″ o.c.	#6 at 72″ o.c.	#7 at 72″ o.c.
	9-4	#6 at 72″ o.c.	#7 at 72″ o.c.	#8 at 72″ o.c.
10-0	4-0 (or less)	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	5-0	#4 at 72″ o.c.	#4 at 72″ o.c.	#4 at 72″ o.c.
	6-0	#4 at 72″ o.c.	#5 at 72″ o.c.	#5 at 72″ o.c.
	7-0	#4 at 72″ o.c.	#6 at 72″ o.c.	#6 at 72″ o.c.
	8-0	#5 at 72″ o.c.	#6 at 72″ o.c.	#7 at 72″ o.c.
	9-0	#6 at 72″ o.c.	#7 at 72″ o.c.	#8 at 72″ o.c.
	10-0	#7 at 72″ o.c.	#8 at 72″ o.c.	#9 at 72″ o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

b. Provisions for this table are based on construction requirements specified in Section 1805.5.2.2.

c. For alternative reinforcement, see Section 1805.5.3.

d. For height of unbalanced backfill, see Section 1805.5.1.2.

TABLE 1805.5(5)
CONCRETE FOUNDATION WALLS[b, c]

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT[e] (feet)	VERTICAL REINFORCEMENT AND SPACING (inches)								
		Design lateral soil load[a] (psf per foot of depth)								
		30			45			60		
		Minimum wall thickness (inches)								
		7.5	9.5	11.5	7.5	9.5	11.5	7.5	9.5	11.5
5	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
6	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	PC	PC	PC
7	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 48″	PC	PC
	7	PC	PC	PC	#5 at 46″	PC	PC	#6 at 48″	PC	PC
8	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 43″	PC	PC
	7	PC	PC	PC	#5 at 41″	PC	PC	#6 at 43″	PC	PC
	8	#5 at 47″	PC	PC	#6 at 43″	PC	PC	#6 at 32″	#6 at 44″	PC
9	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 39″	PC	PC
	7	PC	PC	PC	#5 at 37″	PC	PC	#6 at 38″	#5 at 37″	PC
	8	#5 at 41″	PC	PC	#6 at 38″	#5 at 37″	PC	#7 at 39″	#6 at 39″	#4 at 48″
	9[d]	#6 at 46″	PC	PC	#7 at 41″	#6 at 41″	PC	#7 at 31″	#7 at 41″	#6 at 39″
10	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 37″	PC	PC
	7	PC	PC	PC	#6 at 48″	PC	PC	#6 at 35″	#6 at 48″	PC
	8	#5 at 38″	PC	PC	#7 at 47″	#6 at 47″	PC	#7 at 35″	#7 at 48″	#6 at 45″
	9[d]	#6 at 41″	#4 at 48″	PC	#7 at 37″	#7 at 48″	#4 at 48″	#6 at 22″	#7 at 37″	#7 at 47″
	10[d]	#7 at 45″	#6 at 45″	PC	#7 at 31″	#7 at 40″	#6 at 38″	#6 at 22″	#7 at 30″	#7 at 38″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.157 kPa/m.

a. For design lateral soil loads for different classes of soil, see Section 1610.

b. Provisions for this table are based on construction requirements specified in Section 1805.5.2.1.

c. "PC" means plain concrete.

d. Where design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

e. For height of unbalanced backfill, see Section 1805.5.1.2.

1. Vertical reinforcement shall have a minimum yield strength of 60,000 psi (414 MPa).
2. The specified location of the reinforcement shall equal or exceed the effective depth distance, *d*, noted in Tables 1805.5(2), 1805.5(3) and 1805.5(4) and shall be measured from the face of the exterior (soil) side of the wall to the center of the vertical reinforcement. The reinforcement shall be placed within the tolerances specified in ACI 530.1/ASCE 6/TMS 402, Article 3.4 B7 of the specified location.
3. Grout shall comply with Section 2103.12.
4. Concrete masonry units shall comply with ASTM C 90.
5. Clay masonry units shall comply with ASTM C 652 for hollow brick, except compliance with ASTM C 62 or ASTM C 216 is permitted when solid masonry units are installed in accordance with Table 1805.5(1) for plain masonry.
6. Masonry units shall be installed with Type M or S mortar in accordance with Section 2103.8.
7. The unfactored axial load per linear foot of wall shall not exceed $1.2\,tf'_m$ where t is the specified well thickness in inches and f'_m is the specified compressive strength of masonry in pounds per square inch.

1805.5.3 Alternative foundation wall reinforcement. In lieu of the reinforcement provisions for masonry foundation walls in Table 1805.5(2), 1805.5(3) or 1805.5(4), alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per linear foot (mm) of wall are permitted to be used, provided the spacing of reinforcement does not exceed 72 inches (1829 mm) and reinforcing bar sizes do not exceed No. 11.

1805.5.4 Hollow masonry walls. At least 4 inches (102 mm) of solid masonry shall be provided at girder supports at the top of hollow masonry unit foundation walls.

1805.5.5 Seismic requirements. Reserved.

1805.5.5.1 Seismic requirements for concrete foundations. Reserved.

1805.5.5.2 Seismic requirements for masonry foundation walls. Reserved.

1805.5.6 Foundation wall drainage. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1807.4.2 and 1807.4.3.

1805.5.7 Pier and curtain wall foundations. In regions where the basic wind speed is 100 mph or less, pier and curtain wall foundations are permitted to be used to support light-frame construction not more than two stories in height, provided the following requirements are met:

1. All load-bearing walls shall be placed on continuous concrete footings bonded integrally with the exterior wall footings.
2. The minimum actual thickness of a load-bearing masonry wall shall not be less than 4 inches (102 mm) nominal or 3.625 inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced 6 feet (1829 mm) on center (o.c.).
3. Piers shall be constructed in accordance with Chapter 21 and the following:
   3.1. The unsupported height of the masonry piers shall not exceed 10 times their least dimension.
   3.2. Where structural clay tile or hollow concrete masonry units are used for piers supporting beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar.

   Exception: Unfilled hollow piers are permitted where the unsupported height of the pier is not more than four times its least dimension.

   3.3. Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete or the cavities of the top course shall be filled with concrete or grout.
4. The maximum height of a 4-inch (102 mm) load-bearing masonry foundation wall supporting wood frame walls and floors shall not be more than 4 feet (1219 mm) in height.
5. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry, nor 12 inches (305 mm) for hollow masonry.

1805.6 Foundation plate or sill bolting. Wood foundation plates or sills shall be bolted or strapped to the foundation or foundation wall as provided in Chapter 23.

1805.7 Designs employing lateral bearing. Designs to resist both axial and lateral loads employing posts or poles as columns embedded in earth or embedded in concrete footings in the earth shall conform to the requirements of Sections 1805.7.1 through 1805.7.3.

1805.7.1 Limitations. The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWPA U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B).

1805.7.2 Design criteria. The depth to resist lateral loads shall be determined by the design criteria established in Sections 1805.7.2.1 through 1805.7.2.3, or by other methods approved by the building official.

1805.7.2.1 Nonconstrained. The following formula shall be used in determining the depth of embedment required to resist lateral loads where no constraint is provided at the ground surface, such as rigid floor or rigid ground surface pavement, and where no lateral constraint is provided above the ground surface, such as a structural diaphragm.

$$d = 0.5A\{1 + [1 + (4.36h/A)]^{1/2}\} \qquad \textbf{(Equation 18-1)}$$

where:

A = $2.34P/S_1\, b$.

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet (m).

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet (m) from ground surface to point of application of "P."

P = Applied lateral force in pounds (kN).

S_1 = Allowable lateral soil-bearing pressure as set forth in Section 1804.3 based on a depth of one-third the depth of embedment in pounds per square foot (psf) (kPa).

1805.7.2.2 Constrained. The following formula shall be used to determine the depth of embedment required to resist lateral loads where constraint is provided at the ground surface, such as a rigid floor or pavement.

$$d^2 = 4.25(Ph/S_3\, b) \qquad \textbf{(Equation 18-2)}$$

or alternatively

$$d^2 = 4.25\,(M_g/S_3\, b) \qquad \textbf{(Equation 18-3)}$$

where:

M_g = Moment in the post at grade, in foot-pounds (kN-m).

S_3 = Allowable lateral soil-bearing pressure as set forth in Section 1804.3 based on a depth equal to the depth of embedment in pounds per square foot (kPa).

1805.7.2.3 Vertical load. The resistance to vertical loads shall be determined by the allowable soil-bearing pressure set forth in Table 1804.2.

1805.7.3 Backfill. The backfill in the annular space around columns not embedded in poured footings shall be by one of the following methods:

1. Backfill shall be of concrete with an ultimate strength of 2,000 psi (13.8 MPa) at 28 days. The hole shall not be less than 4 inches (102 mm) larger than the diameter of the column at its bottom or 4 inches (102 mm) larger than the diagonal dimension of a square or rectangular column.
2. Backfill shall be of clean sand. The sand shall be thoroughly compacted by tamping in layers not more than 8 inches (203 mm) in depth.
3. Backfill shall be of controlled low-strength material (CLSM).

1805.8 Design for expansive soils. Footings or foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1805.8.1 or 1805.8.2.

Footing or foundation design need not comply with Section 1805.8.1 or 1805.8.2 where the soil is removed in accordance with Section 1805.8.3, nor where the building official approves stabilization of the soil in accordance with Section 1805.8.4.

1805.8.1 Foundations. Footings or foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

1805.8.2 Slab-on-ground foundations. Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* or *PTI Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils.* Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *WRI/CRSI Design of Slab-on-Ground Foundations* and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with *PTI Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils.* It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

1805.8.3 Removal of expansive soil. Where expansive soil is removed in lieu of designing footings or foundations in accordance with Section 1805.8.1 or 1805.8.2, the soil shall

be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1803.5 or 1803.6.

Exception: Expansive soil need not be removed to the depth of constant moisture, provided the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

1805.8.4 Stabilization. Where the active zone of expansive soils is stabilized in lieu of designing footings or foundations in accordance with Section 1805.8.1 or 1805.8.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

1805.9 Seismic requirements. Reserved.

SECTION 1806
RETAINING WALLS

1806.1 General. Walls built to retain or support the lateral pressure of earth or water or other superimposed loads shall be designed and constructed of masonry, concrete, steel sheet piling or other approved materials.

1806.2 Design. Retaining walls shall be designed to resist the design lateral soil loads in Section 1610, including both dead and live load surcharges to which such walls are subjected, and to ensure stability against overturning, sliding, excessive foundation pressure and water uplift.

1806.3 Hydrostatic pressure. Unless drainage is provided, the hydrostatic head of the water pressure shall be assumed to be equal to the height of the wall.

1806.4 Reinforced masonry retaining walls. Vertical reinforcement for masonry retaining walls shall comply with Table 1806.4 or shall be designed in accordance with ACI 530/ASCE 5/TMS 402. Masonry shall be fully grouted with a minimum f'_m of 1,500 psi (10 343 kPa). Mortar for masonry shall be Type M or S and laid in running bond. The specified location of the reinforcement shall equal or exceed the effective depth distance, d, noted in Table 1806.4 and shall be measured from the exposed side of the wall to the center of the vertical reinforcement. Footings for reinforced masonry retaining walls shall be designed in accordance with ACI 318.

1806.5 Segmental retaining walls. Segmental retaining walls shall be designed in accordance with NCMA Design Manual for Segmental Retaining Walls.

SECTION 1807
DAMPPROOFING AND WATERPROOFING

1807.1 Where required. Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed and dampproofed in accordance with this section, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with Section 1203.4.

1807.1.1 Story above grade plane. Where a basement is considered a story above grade plane and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25 percent or more of the perimeter, the floor and walls shall be dampproofed in accordance with Section 1807.2 and a foundation drain shall be installed in accordance with Section 1807.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of Sections 1802.2.3, 1807.3 and 1807.4.1 shall not apply in this case.

1807.1.2 Under-floor space. The finished ground level of an under-floor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground-water table rises to within 6 inches (152 mm) of the ground level at the outside building perimeter, or that the surface water does not readily drain from the building site, the ground level of the under-floor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of Sections 1802.2.3, 1807.2, 1807.3 and 1807.4 shall not apply in this case.

1807.1.2.1 Flood hazard areas. See Section 3110.

1807.1.3 Ground-water control. Where the ground-water table is lowered and maintained at an elevation not less than 6 inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be dampproofed in accordance with Section 1807.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to operate and the rated capacity of the disposal area of the system.

1807.2 Dampproofing required. Where hydrostatic pressure will not occur as determined by Section 1802.2.3, floors and walls for other than wood foundation systems shall be dampproofed in accordance with this section. Wood foundation systems shall be constructed in accordance with AF&PA Technical Report No. 7.

1807.2.1 Floors. Dampproofing materials for floors shall be installed between the floor and the base course required by Section 1807.4.1, except where a separate floor is provided above a concrete slab.

Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than 6 inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than 4-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1807.2.2 Walls. Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level.

TABLE 1806.4
REINFORCEMENT FOR MASONRY RETAINING WALLS[a]

Nominal Wall thickness [(in.) (mm)]	Wall depth, H, ft (m)	Reinforcement size & spacing for equivalent fluid weight of soil, pcf (kN/m3), of:		
		30 (4.7)	45 (7.1)	60 (9.4)
8 (203)	4.0 (1.2)	#4 at 64 in.	#4 at 40 in.	#4 at 32 in.
	4.7 (1.4)	#4 at 40 in.	#4 at 24 in.	#4 at 16 in.
	5.3 (1.6)	#4 at 24 in.	#4 at 16 in.	#5 at 16 in.
	6.0 (1.8)	#5 at 24 in.	#6 at 16 in.	#8 at 16 in.
	6.7 (2.0)	#5 at 16 in.	#6 at 8 in.	—
10 (254)	4.0 (1.2)	#4 at 72 in.	#4 at 64 in.	#4 at 48 in.
	4.7 (1.4)	#4 at 56 in.	#4 at 40 in.	#4 at 24 in.
	5.3 (1.6)	#4 at 40 in.	#4 at 24 in.	#4 at 16 in.
	6.0 (1.8)	#4 at 24 in.	#4 at 16 in.	#5 at 16 in.
	6.7 (2.0)	#4 at 16 in.	#5 at 16 in.	#6 at 16 in.
	7.3 (2.2)	#5 at 24 in.	#6 at 16 in.	#6 at 8 in.
	8.0 (2.4)	#5 at 16 in.	#6 at 8 in.	—
12 (305)	4.0 (1.2)	#4 at 72 in.	#4 at 72 in.	#4 at 64 in.
	4.7 (1.4)	#4 at 72 in.	#4 at 48 in.	#4 at 40 in.
	5.3 (1.6)	#4 at 48 in.	#4 at 32 in.	#4 at 24 in.
	6.0 (1.8)	#4 at 32 in.	#4 at 24 in.	#4 at 16 in.
	6.7 (2.0)	#4 at 24 in.	#4 at 16 in.	#5 at 16 in.
	7.3 (2.2)	#4 at 16 in.	#5 at 16 in.	#6 at 16 in.
	8.0 (2.4)	#5 at 24 in.	#5 at 16 in.	#7 at 16 in.
	8.7 (2.7)	#5 at 16 in.	#7 at 16 in.	#7 at 8 in.
	9.3 (2.8)	#6 at 16 in.	#7 at 8 in.	—

a. Based on fully grouted masonry; f'_m = 1500 psi (10.3 MPa); d = 5 in., 7 in. and 9 in. (127, 178 and 229 mm) for wall thicknesses of 8, 10, and 12 in. (203, 254, and 305 mm), respectively; level backfill to top of wall.

Dampproofing shall consist of a bituminous material, 3 pounds per square yard (16 N/m^2) of acrylic modified cement, 0.125 inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C 887, any of the materials permitted for waterproofing by Section 1807.3.2 or other approved methods or materials.

1807.2.2.1 Surface preparation of walls. Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than 0.375 inch (9.5 mm) of portland cement mortar. The parging shall be coved at the footing.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

1807.3 Waterproofing required. Where the ground-water investigation required by Section 1802.2.3 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1807.1.3, walls and floors shall be waterproofed in accordance with this section.

1807.3.1 Floors. Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1807.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1807.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1807.3.2.1 Surface preparation of walls. Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1807.2.2.1.

1807.3.3 Joints and penetrations. Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made water-tight utilizing approved methods and materials.

1807.4 Subsoil drainage system. Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1807.1.3 shall be deemed adequate for lowering the ground-water table.

1807.4.1 Floor base course. Floors of basements, except as provided for in Section 1807.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.

1807.4.2 Foundation drain. A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend a minimum of 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1807.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

1807.4.3 Drainage discharge. The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *Florida Building Code, Plumbing.*

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

SECTION 1808
PIER AND PILE FOUNDATIONS

1808.1 Definitions. The following words and terms shall, for the purposes of this section, have the meanings shown herein.

FLEXURAL LENGTH. Flexural length is the length of the pile from the first point of zero lateral deflection to the underside of the pile cap or grade beam.

MICROPILES. Micropiles are 12-inch-diameter (305 mm) or less bored, grouted-in-place piles incorporating steel pipe (casing) and/or steel reinforcement.

PIER FOUNDATIONS. Pier foundations consist of isolated masonry or cast-in-place concrete structural elements extending into firm materials. Piers are relatively short in comparison to their width, with lengths less than or equal to 12 times the least horizontal dimension of the pier. Piers derive their load-carrying capacity through skin friction, through end bearing, or a combination of both.

Belled piers. Belled piers are cast-in-place concrete piers constructed with a base that is larger than the diameter of the remainder of the pier. The belled base is designed to increase the load-bearing area of the pier in end bearing.

PILE FOUNDATIONS. Pile foundations consist of concrete, wood or steel structural elements either driven into the ground or cast in place. Piles are relatively slender in comparison to their length, with lengths exceeding 12 times the least horizontal dimension. Piles derive their load-carrying capacity through skin friction, end bearing or a combination of both.

Augered uncased piles. Augered uncased piles are constructed by depositing concrete into an uncased augered hole, either during or after the withdrawal of the auger.

Caisson piles. Caisson piles are cast-in-place concrete piles extending into bedrock. The upper portion of a caisson pile consists of a cased pile that extends to the bedrock. The lower portion of the caisson pile consists of an uncased socket drilled into the bedrock.

Concrete-filled steel pipe and tube piles. Concrete-filled steel pipe and tube piles are constructed by driving a steel pipe or tube section into the soil and filling the pipe or tube section with concrete. The steel pipe or tube section is left in place during and after the deposition of the concrete.

Driven uncased piles. Driven uncased piles are constructed by driving a steel shell into the soil to shore an unexcavated hole that is later filled with concrete. The steel casing is lifted out of the hole during the deposition of the concrete.

Enlarged base piles. Enlarged base piles are cast-in-place concrete piles constructed with a base that is larger than the diameter of the remainder of the pile. The enlarged base is designed to increase the load-bearing area of the pile in end bearing.

Steel-cased piles. Steel-cased piles are constructed by driving a steel shell into the soil to shore an unexcavated hole. The steel casing is left permanently in place and filled with concrete.

Timber piles. Timber piles are round, tapered timbers with the small (tip) end embedded into the soil.

1808.2 Piers and piles—general requirements.

1808.2.1 Design. Piles are permitted to be designed in accordance with provisions for piers in Section 1808 and Sections 1812.3 through 1812.10 where either of the following conditions exists, subject to the approval of the building official:

1. Group R-3 and U occupancies not exceeding two stories of light-frame construction, or
2. Where the surrounding foundation materials furnish adequate lateral support for the pile.

1808.2.2 General. Pier and pile foundations shall be designed and installed on the basis of a foundation investigation as defined in Section 1802, unless sufficient data upon which to base the design and installation is available.

The investigation and report provisions of Section 1802 shall be expanded to include, but not be limited to, the following:

1. Recommended pier or pile types and installed capacities.
2. Recommended center-to-center spacing of piers or piles.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Pier or pile load test requirements.
7. Durability of pier or pile materials.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

1808.2.3 Special types of piles. The use of types of piles not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such piles. The allowable stresses shall not in any case exceed the limitations specified herein.

1808.2.4 Pile caps. Pile caps shall be of reinforced concrete, and shall include all elements to which piles are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load. The tops of piles shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend at least 4 inches (102 mm) beyond the edges of piles. The tops of piles shall be cut back to sound material before capping.

1808.2.5 Stability. Piers or piles shall be braced to provide lateral stability in all directions. Three or more piles connected by a rigid cap shall be considered braced, provided that the piles are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-pile group in a rigid cap shall be considered to be braced along the axis connecting the two piles. Methods used to brace piers or piles shall be subject to the approval of the building official.

Piles supporting walls shall be driven alternately in lines spaced at least 1 foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the wall piles are adequately braced to provide for lateral stability. A single row of piles without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories or 35 feet (10 668 mm) in height, provided the centers of the piles are located within the width of the foundation wall.

1808.2.6 Structural integrity. Piers or piles shall be installed in such a manner and sequence as to prevent distortion or damage that may adversely affect the structural integrity of piles being installed or already in place.

1808.2.7 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the pier or pile during installation and subsequent thereto and shall be of adequate strength to transmit the vertical and lateral loads and moments occurring at the location of the splice during driving and under service loading. Splices shall develop not less than 50 percent of the least capacity of the pier or pile in bending. In addition, splices occurring in the upper 10 feet (3048 mm) of the embedded portion of the pier or pile shall be capable of resisting at allowable working stresses the moment and shear that would result from an assumed eccentricity of the pier or pile load of 3 inches (76 mm), or the pier or pile shall be braced in accordance with Section 1808.2.5 to other piers or piles that do not have splices in the upper 10 feet (3048 mm) of embedment.

1808.2.8 Allowable pier or pile loads.

1808.2.8.1 Determination of allowable loads. The allowable axial and lateral loads on piers or piles shall be determined by an approved formula, load tests or method of analysis.

1808.2.8.2 Driving criteria. The allowable compressive load on any pile where determined by the application of an approved driving formula shall not exceed 40 tons (356 kN). For allowable loads above 40 tons (356 kN), the wave equation method of analysis shall be used to estimate pile driveability of both driving stresses and net displacement per blow at the ultimate load. Allowable loads shall be verified by load tests in accordance with Section 1808.2.8.3. The formula or wave equation load shall be determined for gravity-drop or power-actuated hammers and the hammer energy used shall be the maximum consistent with the size, strength and weight of the driven piles. The use of a follower is permitted only with the approval of the building official. The introduction of fresh hammer cushion or pile cushion material just prior to final penetration is not permitted.

1808.2.8.3 Load tests. Where design compressive loads per pier or pile are greater than those permitted by Section 1808.2.10 or where the design load for any pier or pile foundation is in doubt, control test piers or piles shall be tested in accordance with ASTM D 1143 or ASTM D 4945. At least one pier or pile shall be test loaded in each area of uniform subsoil conditions. Where required by the building official, additional piers or piles shall be load tested where necessary to establish the safe design capacity. The resulting allowable loads shall not be more than one-half of the ultimate axial load capacity of the test pier or pile as assessed by one of the published methods listed in Section 1808.2.8.3.1 with consideration for the test type, duration and subsoil. The ultimate axial load capacity shall be determined by a registered design

professional with consideration given to tolerable total and differential settlements at design load in accordance with Section 1808.2.12. In subsequent installation of the balance of foundation piles, all piles shall be deemed to have a supporting capacity equal to the control pile where such piles are of the same type, size and relative length as the test pile; are installed using the same or comparable methods and equipment as the test pile; are installed in similar subsoil conditions as the test pile; and, for driven piles, where the rate of penetration (e.g., net displacement per blow) of such piles is equal to or less than that of the test pile driven with the same hammer through a comparable driving distance.

1808.2.8.3.1 Load test evaluation. It shall be permitted to evaluate pile load tests with any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90% Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

1808.2.8.4 Allowable frictional resistance. The assumed frictional resistance developed by any pier or uncased cast-in-place pile shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1804.2, up to a maximum of 500 psf (24 kPa), unless a greater value is allowed by the building official after a soil investigation, as specified in Section 1802, is submitted or a greater value is substantiated by a load test in accordance with Section 1808.2.8.3. Frictional resistance and bearing resistance shall not be assumed to act simultaneously unless recommended by a soil investigation as specified in Section 1802.

1808.2.8.5 Uplift capacity. Where required by the design, the uplift capacity of a single pier or pile shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D 3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section 1808.2.8.3 divided by a factor of safety of two. For pile groups subjected to uplift, the allowable working uplift load for the group shall be the lesser of:

1. The proposed individual pile uplift working load times the number of piles in the group.
2. Two-thirds of the effective weight of the pile group and the soil contained within a block defined by the perimeter of the group and the length of the pile.

1808.2.8.6 Load-bearing capacity. Piers, individual piles and groups of piles shall develop ultimate load capacities of at least twice the design working loads in the designated load-bearing layers. Analysis shall show that no soil layer underlying the designated load-bearing layers causes the load-bearing capacity safety factor to be less than two.

1808.2.8.7 Bent piers or piles. The load-bearing capacity of piers or piles discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative pier or pile.

1808.2.8.8 Overloads on piers or piles. The maximum compressive load on any pier or pile due to mislocation shall not exceed 110 percent of the allowable design load.

1808.2.9 Lateral support.

1808.2.9.1 General. Any soil other than fluid soil shall be deemed to afford sufficient lateral support to the pier or pile to prevent buckling and to permit the design of the pier or pile in accordance with accepted engineering practice and the applicable provisions of this code.

1808.2.9.2 Unbraced piles. Piles standing unbraced in air, water or in fluid soils shall be designed as columns in accordance with the provisions of this code. Such piles driven into firm ground can be considered fixed and laterally supported at 5 feet (1524 mm) below the ground surface and in soft material at 10 feet (3048 mm) below the ground surface unless otherwise prescribed by the building official after a foundation investigation by an approved agency.

1808.2.9.3 Allowable lateral load. Where required by the design, the lateral load capacity of a pier, a single pile or a pile group shall be determined by an approved method of analysis or by lateral load tests to at least twice the proposed design working load. The resulting allowable load shall not be more than one-half of that test load that produces a gross lateral movement of 1 inch (25 mm) at the ground surface.

1808.2.10 Use of higher allowable pier or pile stresses. Allowable stresses greater than those specified for piers or for each pile type in Sections 1809 and 1810 are permitted where supporting data justifying such higher stresses is filed with the building official. Such substantiating data shall include:

1. A soils investigation in accordance with Section 1802.
2. Pier or pile load tests in accordance with Section 1808.2.8.3, regardless of the load supported by the pier or pile.

The design and installation of the pier or pile foundation shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and pier or pile foundations who shall certify to the building official that the piers or piles as installed satisfy the design criteria.

1808.2.11 Piles in subsiding areas. Where piles are installed through subsiding fills or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces that may be imposed on the piles by the subsiding upper strata.

Where the influence of subsiding fills is considered as imposing loads on the pile, the allowable stresses specified

in this chapter are permitted to be increased where satisfactory substantiating data are submitted.

1808.2.12 Settlement analysis. The settlement of piers, individual piles or groups of piles shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any stresses to exceed allowable values.

1808.2.13 Preexcavation. The use of jetting, augering or other methods of preexcavation shall be subject to the approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for piers or piles subject to load tests and in such a manner that will not impair the carrying capacity of the piers or piles already in place or damage adjacent structures. Pile tips shall be driven below the preexcavated depth until the required resistance or penetration is obtained.

1808.2.14 Installation sequence. Piles shall be installed in such sequence as to avoid compacting the surrounding soil to the extent that other piles cannot be installed properly, and to prevent ground movements that are capable of damaging adjacent structures.

1808.2.15 Use of vibratory drivers. Vibratory drivers shall only be used to install piles where the pile load capacity is verified by load tests in accordance with Section 1808.2.8.3. The installation of production piles shall be controlled according to power consumption, rate of penetration or other approved means that ensure pile capacities equal or exceed those of the test piles.

1808.2.16 Pile driveability. Pile cross sections shall be of sufficient size and strength to withstand driving stresses without damage to the pile, and to provide sufficient stiffness to transmit the required driving forces.

1808.2.17 Protection of pile materials. Where boring records or site conditions indicate possible deleterious action on pier or pile materials because of soil constituents, changing water levels or other factors, the pier or pile materials shall be adequately protected by materials, methods or processes approved by the building official. Protective materials shall be applied to the piles so as not to be rendered ineffective by driving. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence.

1808.2.18 Use of existing piers or piles. Piers or piles left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the piers or piles are sound and meet the requirements of this code. Such piers or piles shall be load tested or redriven to verify their capacities. The design load applied to such piers or piles shall be the lowest allowable load as determined by tests or redriving data.

1808.2.19 Heaved piles. Piles that have heaved during the driving of adjacent piles shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the pile shall be verified by load tests in accordance with Section 1808.2.8.3.

1808.2.20 Identification. Pier or pile materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

1808.2.21 Pier or pile location plan. A plan showing the location and designation of piers or piles by an identification system shall be filed with the building official prior to installation of such piers or piles. Detailed records for piers or individual piles shall bear an identification corresponding to that shown on the plan.

1808.2.22 Special inspection. Reserved.

1808.2.23 Seismic design of piers or piles. Reserved.

1808.2.23.1 Seismic Design Category C. Reserved.

1803.2.23.1.1 Connection to pile cap. Reserved.

1803.2.23.1.2 Design details. Reserved.

1803.2.23.2 Seismic Design Category D, E, or F. Reserved.

1803.2.23.2.1 Design details for piers, piles, and grade beams. Reserved.

1808.2.23.2.2 Connection to pile cap. Reserved.

1808.2.23.2.3 Flexural strength. Reserved.

SECTION 1809
DRIVEN PILE FOUNDATIONS

1809.1 Timber piles. Timber piles shall be designed in accordance with the AF&PA NDS.

1809.1.1 Materials. Round timber piles shall conform to ASTM D 25. Sawn timber piles shall conform to DOC PS-20.

1809.1.2 Preservative treatment. Timber piles used to support permanent structures shall be treated in accordance with this section unless it is established that the tops of the untreated timber piles will be below the lowest ground-water level assumed to exist during the life of the structure. Preservative and minimum final retention shall be in accordance with AWPA U1 (Commodity Specification E, Use Category 4C) for round timber piles and AWPA U1 (Commodity Specification A, Use Category 4B) for sawn timber piles. Preservative-treated timber piles shall be subject to a quality control program administered by an approved agency. Pile cutoffs shall be treated in accordance with AWPA M4.

1809.1.3 Defective piles. Any substantial sudden increase in rate of penetration of a timber pile shall be investigated for possible damage. If the sudden increase in rate of penetration cannot be correlated to soil strata, the pile shall be removed for inspection or rejected.

1809.1.4 Allowable stresses. The allowable stresses shall be in accordance with the AF&PA NDS.

1809.2 Precast concrete piles.

1809.2.1 General. The materials, reinforcement and installation of precast concrete piles shall conform to Sections 1809.2.1.1 through 1809.2.1.4.

1809.2.1.1 Design and manufacture. Piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

1809.2.1.2 Minimum dimension. The minimum lateral dimension shall be 8 inches (203 mm). Corners of square piles shall be chamfered.

1809.2.1.3 Reinforcement. Longitudinal steel shall be arranged in a symmetrical pattern and be laterally tied with steel ties or wire spiral spaced not more than 4 inches (102 mm) apart, center to center, for a distance of 2 feet (610 mm) from the ends of the pile; and not more than 6 inches (152 mm) elsewhere except that at the ends of each pile, the first five ties or spirals shall be spaced 1 inch (25 mm) center to center. The gage of ties and spirals shall be as follows:

For piles having a diameter of 16 inches (406 mm) or less, wire shall not be smaller than 0.22 inch (5.6 mm) (No. 5 gage).

For piles having a diameter of more than 16 inches (406 mm) and less than 20 inches (508 mm), wire shall not be smaller than 0.238 inch (6 mm) (No. 4 gage).

For piles having a diameter of 20 inches (508 mm) and larger, wire shall not be smaller than 0.25 inch (6.4 mm) round or 0.259 inch (6.6 mm) (No. 3 gage).

1809.2.1.4 Installation. Piles shall be handled and driven so as not to cause injury or overstressing, which affects durability or strength.

1809.2.2 Precast nonprestressed piles. Precast nonprestressed concrete piles shall conform to Sections 1809.2.2.1 through 1809.2.2.5.

1809.2.2.1 Materials. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 3,000 psi (20.68 MPa).

1809.2.2.2 Minimum reinforcement. The minimum amount of longitudinal reinforcement shall be 0.8 percent of the concrete section and shall consist of at least four bars.

1809.2.2.2.1 Seismic reinforcement in Seismic Design Category C. Reserved.

1809.2.2.2.2 Seismic reinforcement in Seismic Design Category D, E or F. Reserved.

1809.2.2.3 Allowable stresses. The allowable compressive stress in the concrete shall not exceed 33 percent of the 28-day specified compressive strength (f'_c) applied to the gross cross-sectional area of the pile. The allowable compressive stress in the reinforcing steel shall not exceed 40 percent of the yield strength of the steel (f_y) or a maximum of 30,000 psi (207 MPa). The allowable tensile stress in the reinforcing steel shall not exceed 50 percent of the yield strength of the steel (f_y) or a maximum of 24,000 psi (165 MPa).

1809.2.2.4 Installation. A precast concrete pile shall not be driven before the concrete has attained a compressive strength of at least 75 percent of the 28-day specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1809.2.2.5 Concrete cover. Reinforcement for piles that are not manufactured under plant conditions shall have a concrete cover of not less than 2 inches (51 mm).

Reinforcement for piles manufactured under plant control conditions shall have a concrete cover of not less than 1.25 inches (32 mm) for No. 5 bars and smaller, and not less than 1.5 inches (38 mm) for No. 6 through No. 11 bars except that longitudinal bars spaced less than 1.5 inches (38 mm) clear distance apart shall be considered bundled bars for which the minimum concrete cover shall be equal to that for the equivalent diameter of the bundled bars.

Reinforcement for piles exposed to seawater shall have a concrete cover of not less than 3 inches (76 mm).

1809.2.3 Precast prestressed piles. Precast prestressed concrete piles shall conform to the requirements of Sections 1809.2.3.1 through 1809.2.3.5.

1809.2.3.1 Materials. Prestressing steel shall conform to ASTM A 416. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 5,000 psi (34.48 MPa).

1809.2.3.2 Design. Precast prestressed piles shall be designed to resist stresses induced by handling and driving as well as by loads. The effective prestress in the pile shall not be less than 400 psi (2.76 MPa) for piles up to 30 feet (9144 mm) in length, 550 psi (3.79 MPa) for piles up to 50 feet (15 240 mm) in length and 700 psi (4.83 MPa) for piles greater than 50 feet (15 240 mm) in length.

Effective prestress shall be based on an assumed loss of 30,000 psi (207 MPa) in the prestressing steel. The tensile stress in the prestressing steel shall not exceed the values specified in ACI 318.

1809.2.3.2.1 Design in Seismic Design Category C. Reserved.

1809.2.3.2.2 Design in Seismic Design Category D, E or F. Reserved.

1809.2.3.3 Allowable stresses. The allowable design compressive stress, f_c, in concrete shall be determined as follows:

$$f_c = 0.33f'_c - 0.27f_{pc} \qquad \textbf{(Equation 18-10)}$$

where:

f'_c = The 28-day specified compressive strength of the concrete.

f_{pc} = The effective prestress stress on the gross section.

1809.2.3.4 Installation. A prestressed pile shall not be driven before the concrete has attained a compressive strength of at least 75 percent of the 28-day specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1809.2.3.5 Concrete cover. Prestressing steel and pile reinforcement shall have a concrete cover of not less than $1^1/_4$ inches (32 mm) for square piles of 12 inches (305 mm) or smaller size and $1^1/_2$ inches (38 mm) for larger piles, except that for piles exposed to seawater, the minimum protective concrete cover shall not be less than $2^1/_2$ inches (64 mm).

1809.3 Structural steel piles. Structural steel piles shall conform to the requirements of Sections 1809.3.1 through 1809.3.4.

1809.3.1 Materials. Structural steel piles, steel pipe and fully welded steel piles fabricated from plates shall conform to ASTM A 36, ASTM A 252, ASTM A 283, ASTM A 572, ASTM A 588, ASTM A 690, ASTM A 913 or ASTM A 992.

1809.3.2 Allowable stresses. The allowable axial stresses shall not exceed 35 percent of the minimum specified yield strength (F_y).

Exception: Where justified in accordance with Section 1808.2.10, the allowable axial stress is permitted to be increased above $0.35F_y$, but shall not exceed $0.5F_y$.

1809.3.3 Dimensions of H-piles. Sections of H-piles shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall not be less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall not be less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $^3/_8$ inch (9.5 mm).

1809.3.4 Dimensions of steel pipe piles. Steel pipe piles driven open ended shall have a nominal outside diameter of not less than 8 inches (203 mm). The pipe shall have a minimum cross section of 0.34 square inch (219 mm^2) to resist each 1,000 foot-pounds (1356 N-m) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 Mpa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where pipe wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided.

SECTION 1810
CAST-IN-PLACE CONCRETE PILE FOUNDATIONS

1810.1 General. The materials, reinforcement and installation of cast-in-place concrete piles shall conform to Sections 1810.1.1 through 1810.1.3.

1810.1.1 Materials. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 2,500 psi (17.24 MPa). Where concrete is placed through a funnel hopper at the top of the pile, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 6 inches (152 mm). Where concrete is to be pumped, the mix design including slump shall be adjusted to produce a pumpable concrete.

1810.1.2 Reinforcement. Except for steel dowels embedded 5 feet (1524 mm) or less in the pile and as provided in Section 1810.3.4, reinforcement where required shall be assembled and tied together and shall be placed in the pile as a unit before the reinforced portion of the pile is filled with concrete except in augered uncased cast-in-place piles. Tied reinforcement in augered uncased cast-in-place piles shall be placed after piles are concreted, while the concrete is still in a semifluid state.

1810.1.2.1 Reinforcement in Seismic Design Category C. Reserved.

1810.1.2.2 Reinforcement in Seismic Design Category D, E or F. Reserved.

1810.1.3 Concrete placement. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized shaft. Concrete shall not be placed through water except where a tremie or other approved method is used. When depositing concrete from the top of the pile, the concrete shall not be chuted directly into the pile but shall be poured in a rapid and continuous operation through a funnel hopper centered at the top of the pile.

1810.2 Enlarged base piles. Enlarged base piles shall conform to the requirements of Sections 1810.2.1 through 1810.2.5.

1810.2.1 Materials. The maximum size for coarse aggregate for concrete shall be $^3/_4$ inch (19.1 mm). Concrete to be compacted shall have a zero slump.

1810.2.2 Allowable stresses. The maximum allowable design compressive stress for concrete not placed in a permanent steel casing shall be 25 percent of the 28-day specified compressive strength (f'_c). Where the concrete is place in a permanent steel casing, the maximum allowable concrete stress shall be 33 percent of the 28-day specified compressive strength (f'_c).

1810.2.3 Installation. Enlarged bases formed either by compacting concrete or driving a precast base shall be formed in or driven into granular soils. Piles shall be constructed in the same manner as successful prototype test piles driven for the project. Pile shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the pile shaft shall be filled sufficiently to reestablish lateral support by the soil. Where pile heave occurs, the pile shall be replaced unless it is demonstrated that the pile is undamaged and capable of carrying twice its design load.

1810.2.4 Load-bearing capacity. Pile load-bearing capacity shall be verified by load tests in accordance with Section 1808.2.8.3.

1810.2.5 Concrete cover. The minimum concrete cover shall be $2^1/_2$ inches (64 mm) for uncased shafts and 1 inch (25 mm) for cased shafts.

1810.3 Drilled or augered uncased piles. Drilled or augered uncased piles shall conform to Sections 1810.3.1 through 1810.3.5.

1810.3.1 Allowable stresses. The allowable design stress in the concrete of drilled or augered uncased piles shall not exceed 33 percent of the 28-day specified compressive strength (f'_c). The allowable compressive stress of reinforcement shall not exceed 40 percent of the yield strength of the steel or 25,500 psi (175.8 MPa).

1810.3.2 Dimensions. The pile length shall not exceed 30 times the average diameter. The minimum diameter shall be 12 inches (305 mm).

Exception: The length of the pile is permitted to exceed 30 times the diameter, provided that the design and installation of the pile foundation are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and pile foundations. The registered design professional shall certify to the building official that the piles were installed in compliance with the approved construction documents.

1810.3.3 Installation. Where pile shafts are formed through unstable soils and concrete is placed in an open-drilled hole, a steel liner shall be inserted in the hole prior to placing the concrete. Where the steel liner is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the liner at a sufficient height to offset any hydrostatic or lateral soil pressure.

Where concrete is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. The auger shall be withdrawn in continuous increments. Concreting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete volumes shall be measured to ensure that the volume of concrete placed in each pile is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any pile is interrupted or a loss of concreting pressure occurs, the pile shall be redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete pressure was lost and reformed. Augered cast-in-place piles shall not be installed within six pile diameters center to center of a pile filled with concrete less than 12 hours old, unless approved by the building official. If the concrete level in any completed pile drops due to installation of an adjacent pile, the pile shall be replaced.

1810.3.4 Reinforcement. For piles installed with a hollow-stem auger where full-length longitudinal steel reinforcement is placed without lateral ties, the reinforcement shall be placed through the hollow stem of the auger prior to filling the pile with concrete. All pile reinforcement shall have a concrete cover of not less than 2.5 inches (64 mm).

Exception: Where physical constraints do not allow the placement of the longitudinal reinforcement prior to filling the pile with concrete or where partial-length longitudinal reinforcement is placed without lateral ties, the reinforcement is allowed to be placed after the piles are completely concreted but while concrete is still in a semi-fluid state.

1810.3.5 Reinforcement in Seismic Design Category C, D, E or F. Reserved.

1810.4 Driven uncased piles. Driven uncased piles shall conform to Sections 1810.4.1 through 1810.4.4.

1810.4.1 Allowable stresses. The allowable design stress in the concrete shall not exceed 25 percent of the 28-day specified compressive strength (f'_c) applied to a cross-sectional area not greater than the inside area of the drive casing or mandrel.

1810.4.2 Dimensions. The pile length shall not exceed 30 times the average diameter. The minimum diameter shall be 12 inches (305 mm).

Exception: The length of the pile is permitted to exceed 30 times the diameter, provided that the design and installation of the pile foundation is under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and pile foundations. The registered design professional shall certify to the building official that the piles were installed in compliance with the approved design.

1810.4.3 Installation. Piles shall not be driven within six pile diameters center to center in granular soils or within one-half the pile length in cohesive soils of a pile filled with concrete less than 48 hours old unless approved by the building official. If the concrete surface in any completed pile rises or drops, the pile shall be replaced. Piles shall not be installed in soils that could cause pile heave.

1810.4.4 Concrete cover. Pile reinforcement shall have a concrete cover of not less than 2.5 inches (64 mm), measured from the inside face of the drive casing or mandrel.

1810.5 Steel-cased piles. Steel-cased piles shall comply with the requirements of Sections 1810.5.1 through 1810.5.4.

1810.5.1 Materials. Pile shells or casings shall be of steel and shall be sufficiently strong to resist collapse and sufficiently water tight to exclude any foreign materials during the placing of concrete. Steel shells shall have a sealed tip with a diameter of not less than 8 inches (203 mm).

1810.5.2 Allowable stresses. The allowable design compressive stress in the concrete shall not exceed 33 percent of the 28-day specified compressive strength (f'_c). The allowable concrete compressive stress shall be 0.40 (f'_c) for that portion of the pile meeting the conditions specified in Sections 1810.5.2.1 through 1810.5.2.4.

1810.5.2.1 Shell thickness. The thickness of the steel shell shall not be less than manufacturer's standard gage No. 14 gage (0.068 inch) (1.75 mm) minimum.

1810.5.2.2 Shell type. The shell shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.

1810.5.2.3 Strength. The ratio of steel yield strength (f_y) to 28-day specified compressive strength (f'_c) shall not be less than six.

1810.5.2.4 Diameter. The nominal pile diameter shall not be greater than 16 inches (406 mm).

1810.5.3 Installation. Steel shells shall be mandrel driven their full length in contact with the surrounding soil.

The steel shells shall be driven in such order and with such spacing as to ensure against distortion of or injury to piles already in place. A pile shall not be driven within four and one-half average pile diameters of a pile filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in steel shells within heave range of driving.

1810.5.4 Reinforcement. Reinforcement shall not be placed within 1 inch (25 mm) of the steel shell. Reinforcing shall be required for unsupported pile lengths or where the pile is designed to resist uplift or unbalanced lateral loads.

1810.5.4.1 Seismic reinforcement. Reserved.

1810.6 Concrete-filled steel pipe and tube piles. Concrete-filled steel pipe and tube piles shall conform to the requirements of Sections 1810.6.1 through 1810.6.5.

1810.6.1 Materials. Steel pipe and tube sections used for piles shall conform to ASTM A 252 or ASTM A 283. Concrete shall conform to Section 1810.1.1. The maximum coarse aggregate size shall be $^3/_4$ inch (19.1 mm).

1810.6.2 Allowable stresses. The allowable design compressive stress in the concrete shall not exceed 33 percent of the 28-day specified compressive strength (f'_c). The allowable design compressive stress in the steel shall not exceed 35 percent of the minimum specified yield strength of the steel (F_y), provided F_y shall not be assumed greater than 36,000 psi (248 MPa) for computational purposes.

Exception: Where justified in accordance with Section 1808.2.10, the allowable stresses are permitted to be increased to 0.50 F_y.

1810.6.3 Minimum dimensions. Piles shall have a nominal outside diameter of not less than 8 inches (203 mm) and a minimum wall thickness in accordance with Section 1809.3.4. For mandrel-driven pipe piles, the minimum wall thickness shall be $^1/_{10}$ inch (2.5 mm).

1810.6.4 Reinforcement. Reinforcement steel shall conform to Section 1810.1.2. Reinforcement shall not be placed within 1 inch (25 mm) of the steel casing.

1810.6.4.1 Seismic reinforcement. Reserved.

1810.6.5 Placing concrete. The placement of concrete shall conform to Section 1810.1.3, but is permitted to be chuted directly into smooth-sided pipes and tubes without a centering funnel hopper.

1810.7 Caisson piles. Caisson piles shall conform to the requirements of Sections 1810.7.1 through 1810.7.6.

1810.7.1 Construction. Caisson piles shall consist of a shaft section of concrete-filled pipe extending to bedrock with an uncased socket drilled into the bedrock and filled with concrete. The caisson pile shall have a full-length structural steel core or a stub core installed in the rock socket and extending into the pipe portion a distance equal to the socket depth.

1810.7.2 Materials. Pipe and steel cores shall conform to the material requirements in Section 1809.3. Pipes shall have a minimum wall thickness of $^3/_8$ inch (9.5 mm) and shall be fitted with a suitable steel-driving shoe welded to the bottom of the pipe. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 4,000 psi (27.58 MPa). The concrete mix shall be designed and proportioned so as to produce a cohesive workable mix with a slump of 4 inches to 6 inches (102 mm to 152 mm).

1810.7.3 Design. The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the caisson pile with a minimum safety factor of two, but the depth shall not be less than the outside diameter of the pipe. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket. The minimum outside diameter of the caisson pile shall be 18 inches (457 mm), and the diameter of the rock socket shall be approximately equal to the inside diameter of the pile.

1810.7.4 Structural core. The gross cross-sectional area of the structural steel core shall not exceed 25 percent of the gross area of the caisson. The minimum clearance between the structural core and the pipe shall be 2 inches (51 mm). Where cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

1810.7.5 Allowable stresses. The allowable design compressive stresses shall not exceed the following: concrete, $0.33f'_c$; steel pipe, $0.35F_y$ and structural steel core, $0.50F_y$.

1810.7.6 Installation. The rock socket and pile shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket. Concrete shall not be placed through water except where a tremie or other approved method is used.

1810.8 Micropiles. Micropiles shall conform to the requirements of Sections 1810.8.1 through 1810.8.5.

1810.8.1 Construction. Micropiles shall consist of a grouted section reinforced with steel pipe or steel reinforcing. Micropiles shall develop their load-carrying capacity through a bond zone in soil, bedrock or a combination of soil and bedrock. The full length of the micropile shall contain either a steel pipe or steel reinforcement.

1810.8.2 Materials. Grout shall have a 28-day specified compressive strength (f'_c) of not less than 4,000 psi (27.58 MPa). The grout mix shall be designed and proportioned so as to produce a pumpable mixture. Reinforcement steel shall be deformed bars in accordance with ASTM A 615 Grade 60 or 75 or ASTM A 722 Grade 150.

Pipe/casing shall have a minimum wall thickness of $^3/_{16}$ inch (4.8 mm) and as required to meet Section 1808.2.7. Pipe/casing shall meet the tensile requirements of ASTM A 252 Grade 3, except the minimum yield strength shall be as

used in the design submittal [typically 50,000 psi to 80,000 psi (345 MPa to 552 MPa)] and minimum elongation shall be 15 percent.

1810.8.3 Allowable stresses. The allowable design compressive stress on grout shall not exceed $0.33f'_c$. The allowable design compressive stress on steel pipe and steel reinforcement shall not exceed the lesser of $0.4\ F_y$, or 32,000 psi (220 MPa). The allowable design tensile stress for steel reinforcement shall not exceed $0.60\ F_y$. The allowable design tensile stress for the cement grout shall be zero.

1810.8.4 Reinforcement. For piles or portions of piles grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or steel reinforcement shall be designed to carry at least 40 percent of the design compression load. Piles or portions of piles grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe is used for reinforcement, the portion of the cement grout enclosed within the pipe is permitted to be included at the allowable stress of the grout.

1810.8.4.1 Seismic reinforcement. Reserved.

1810.8.5 Installation. The pile shall be permitted to be formed in a hole advanced by rotary or percussive drilling methods, with or without casing. The pile shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the pile until grout of suitable quality returns at the top of the pile. The following requirements apply to specific installation methods:

1. For piles grouted inside a temporary casing, the reinforcing steel shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the pile to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to check that the flow of grout inside the casing is not obstructed.
2. For a pile or portion of a pile grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For piles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent piles shall not be drilled near piles that have been grouted until the grout has had sufficient time to harden.
5. Piles shall be grouted as soon as possible after drilling is completed.
6. For piles designed with casing full length, the casing must be pulled back to the top of the bond zone and reinserted or some other suitable means shall be employed to verify grout coverage outside the casing.

SECTION 1811
COMPOSITE PILES

1811.1 General. Composite piles shall conform to the requirements of Sections 1811.2 through 1811.5.

1811.2 Design. Composite piles consisting of two or more approved pile types shall be designed to meet the conditions of installation.

1811.3 Limitation of load. The maximum allowable load shall be limited by the capacity of the weakest section incorporated in the pile.

1811.4 Splices. Splices between concrete and steel or wood sections shall be designed to prevent separation both before and after the concrete portion has set, and to ensure the alignment and transmission of the total pile load. Splices shall be designed to resist uplift caused by upheaval during driving of adjacent piles, and shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section.

1811.5 Seismic reinforcement. Reserved.

SECTION 1812
PIER FOUNDATIONS

1812.1 General. Isolated and multiple piers used as foundations shall conform to the requirements of Sections 1812.2 through 1812.10, as well as the applicable provisions of Section 1808.2.

1812.2 Lateral dimensions and height. The minimum dimension of isolated piers used as foundations shall be 2 feet (610 mm), and the height shall not exceed 12 times the least horizontal dimension.

1812.3 Materials. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 2,500 psi (17.24 MPa). Where concrete is placed through a funnel hopper at the top of the pier, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than 4 inches (102 mm) and not more than 6 inches (152 mm). Where concrete is to be pumped, the mix design including slump shall be adjusted to produce a pumpable concrete.

1812.4 Reinforcement. Except for steel dowels embedded 5 feet (1524 mm) or less in the pier, reinforcement where required shall be assembled and tied together and shall be placed in the pier hole as a unit before the reinforced portion of the pier is filled with concrete.

Exception: Reinforcement is permitted to be wet set and the $2^1/_2$- inch (64 mm) concrete cover requirement be reduced to 2 inches (51 mm) for Group R-3 and U occupancies not exceeding two stories of light-frame construction, provided the construction method can be demonstrated to the satisfaction of the building official.

Reinforcement shall conform to the requirements of Sections 1810.1.2.1 and 1810.1.2.2.

Exceptions:

1. Isolated piers supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame

construction are permitted to be reinforced as required by rational analysis but not less than a minimum of one No. 4 bar, without ties or spirals, when detailed so the pier is not subject to lateral loads and the soil is determined to be of adequate stiffness.

2. Isolated piers supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction are permitted to be reinforced as required by rational analysis but not less than one No. 4 bar, without ties or spirals, when the soil is determined to be of adequate stiffness.
3. Piers supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction are permitted to be reinforced as required by rational analysis but not less than two No. 4 bars, without ties or spirals, when the soil is determined to be of adequate stiffness.
4. Reserved.

1812.5 Concrete placement. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized shaft. Concrete shall not be placed through water except where a tremie or other approved method is used. When depositing concrete from the top of the pier, the concrete shall not be chuted directly into the pier but shall be poured in a rapid and continuous operation through a funnel hopper centered at the top of the pier.

1812.6 Belled bottoms. Where pier foundations are belled at the bottom, the edge thickness of the bell shall not be less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1812.7 Masonry. Where the unsupported height of foundation piers exceeds six times the least dimension, the allowable working stress on piers of unit masonry shall be reduced in accordance with ACI 530/ASCE 5/TMS 402.

1812.8 Concrete. Where adequate lateral support is not provided, and the unsupported height to least lateral dimension does not exceed three, piers of plain concrete shall be designed and constructed as pilasters in accordance with ACI 318. Where the unsupported height to least lateral dimension exceeds three, piers shall be constructed of reinforced concrete, and shall conform to the requirements for columns in ACI 318.

Exception: Where adequate lateral support is furnished by the surrounding materials as defined in Section 1808.2.9, piers are permitted to be constructed of plain or reinforced concrete. The requirements of ACI 318 for bearing on concrete shall apply.

1812.9 Steel shell. Where concrete piers are entirely encased with a circular steel shell, and the area of the shell steel is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1808.2.17. Horizontal joints in the shell shall be spliced to comply with Section 1808.2.7.

1812.10 Dewatering. *Where* piers are carried to depths below water level, the piers shall be constructed by a method that will provide accurate preparation and inspection of the bottom, and the depositing or construction of sound concrete or other masonry in the dry.

SECTIONS 1813 – 1815
RESERVED

SECTION 1816
TERMITE PROTECTION

1816.1 Termite protection. Termite protection shall be provided by registered termiticides, including soil-applied pesticides, baiting systems and pesticides applied to wood, or other approved methods of termite protection labeled for use as a preventative treatment to new construction. See Section 202, Registered Termiticide. Upon completion of the application of the termite protective treatment, a certificate of compliance shall be issued to the building department by the licensed pest control company that contains the following statement: "The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services."

1816.1.1 If soil treatment is used for subterranean termite prevention, the initial chemical soil treatment inside the foundation perimeter shall be done after all excavation, backfilling and compaction is complete.

1816.1.2 If soil treatment is used for subterranean termite prevention, soil area disturbed after initial chemical soil treatment shall be retreated with a chemical soil treatment, including spaces boxed or formed.

1816.1.3 If soil treatment is used for subterranean termite prevention, space in concrete floors boxed out or formed for the subsequent installation of plumbing traps, drains or any other purpose shall be created by using plastic or metal permanently placed forms of sufficient depth to eliminate any planned soil disturbance after initial chemical soil treatment.

1816.1.4 If soil treatment is used for subterranean termite prevention, chemically treated soil shall be protected with a minimum 6 millimeter vapor retarder to protect against rainfall dilution. If rainfall occurs before vapor retarder placement, retreatment is required. Any work, including placement of reinforcing steel, done after chemical treatment until the concrete floor is poured, shall be done in such manner as to avoid penetrating or disturbing treated soil.

1816.1.5 If soil treatment is used for subterranean termite prevention, concrete overpour or mortar accumulated along the exterior foundation perimeter shall be removed prior to exterior chemical soil treatment to enhance vertical penetration of the chemicals.

1816.1.6 If soil treatment is used for subterranean termite prevention, chemical soil treatments shall also be applied under all exterior concrete or grade within 1 foot (305 mm) of the primary structure sidewalls. Also, a vertical chemical barrier shall be applied promptly after construction is completed, including initial landscaping and irrigation/sprinkler

installation. Any soil disturbed after the chemical vertical barrier is applied shall be promptly retreated.

1816.1.7 If a registered termiticide formulated and registered as a bait system is used for subterranean termite prevention, Sections 1816.1.1 through 1816.1.6 do not apply; however, a signed contract assuring the installation, maintenance and monitoring of the baiting system for a minimum of 5 years from the issue of the certificate of occupancy shall be provided to the building official prior to the pouring of the slab, and the system must be installed prior to final building approval. If the baiting system directions for use require a monitoring phase prior to installation of the pesticide active ingredient, the installation of the monitoring phase components shall be deemed to constitute installation of the system.

1816.1.8 If a registered termiticide formulated and registered as a wood treatment is used for subterranean termite prevention, Sections 1816.1.1 through 1816.1.6 do not apply. Application of the wood-treatment termiticide shall be as required by label directions for use, and must be completed prior to final building approval. Changes in framing or additions to framing in areas of the structure requiring treatment that occur after the initial wood treatment must be treated prior to final building approval.

1816.2 Penetration.

1816.2.1 Protective sleeves around metallic piping penetrating concrete slab-on-grade floors shall not be of cellulose-containing materials.

1816.2.2 If soil treatment is used for subterranean termite protection, the protective sleeve shall meet the following minimum requirements:

1. The sleeve shall have a nominal thickness of 0.025 inch.
2. The sleeve shall be sized for the pipe.
3. The sleeve shall be sealed within the slab using a noncorrosive mechanical clamping device to eliminate the annular space between the pipe and pipe sleeve.

SECTION 1817
HIGH-VELOCITY HURRICANE ZONES – EXCAVATIONS

1817.1 General. Until provisions for permanent support have been made, all excavations shall be properly guarded and protected so as to prevent them from becoming dangerous to life and property and shall be sheet piled, braced and/or shored, where necessary, to prevent the adjoining earth from caving in; such protection to be provided by the person causing the excavation to be made. All excavations shall comply with the minimum requirements of Section 553.60, *Florida Statute* "Trench Safety Act," and 29 CFR 1926-650 (P) "Occupational Safety and Health Administration Excavation Safety Act." No excavation, for any purpose, shall extend within 1 foot (305 mm) of the angle of repose of any soil bearing footing or foundation unless such footing or foundation is first properly underpinned or protected against settlement.

1817.2 Permanent excavations. No permanent excavation shall be made nor shall any construction excavations be left on any lot that will endanger adjoining property or buildings or be a menace to public health or safety. Any such excavations made or maintained shall be properly drained and such drainage provisions shall function properly as long as the excavation exists. Permanent excavations shall have retaining walls of steel, masonry, concrete or similar approved material of sufficient strength to retain the embankment together with any surcharged loads.

1817.3 Enforcement. Where, in the opinion of the building official, an unsafe condition may result or damage may occur as the result of an excavation, he or she may order the work stopped or may approve the work of excavation subject to such limitations, as he or she may deem necessary.

SECTION 1818
HIGH-VELOCITY HURRICANE ZONES—BEARING CAPACITY OF SOIL

1818.1 Design bearing capacity. Plans for new buildings, structures or additions shall clearly identify the nature of the soil under the structure and the allowable bearing capacity used in sizing the building foundation support system.

Exception: See Section1822.1 for plans for new buildings, structures or additions that are to be supported on a piling foundation system.

1818.2 Allowable bearing capacity. Prior to the installation of any footing foundation system for new buildings, structures or additions, the building official shall be provided with a statement of allowable bearing capacity from an architect or professional engineer. Said statement shall clearly identify the allowable in-place bearing capacity of the building pad for the new building or addition and verify the existing soil conditions. The certified in-place bearing capacity shall have been determined using recognized tests or rational analysis and shall meet or exceed the design bearing capacity identified under Section 1818.1.

SECTION 1819
HIGH-VELOCITY HURRICANE ZONES—SOIL BEARING FOUNDATIONS

1819.1 General. Footings shall be constructed of reinforced concrete, as set forth in Chapter 19 (High-Velocity Hurricane Zones) of this code and in this section, and shall, insofar as is practicable, be so designed that the soil pressure shall be reasonably uniform to minimize differential settlement.

1819.2 Continuous wall footings.

1819.2.1 Footings under walls shall be continuous or continuity otherwise provided and shall be not less than required to keep the soil pressure within that set forth in Section1818 nor less than the following minimums:

Allowable bearing capacity pounds per square foot	No. of Stories	Minimum Depth and Width [2] (inches)
2000	1	12 x 16[1]
2000	2	12 x 24

For SI: 1 inch = 25.4 mm; 1 pound per square foot 47.89 Pa.

Based on rational analysis and soil investigation as set forth in section Section 1818, the footing size or bearing capacity may vary, but the minimum width of a footing under the main walls of the building shall not be less than 16 inches nor less than 8 inches more than the width of the wall.

NOTES:

1. For single-story wood frame exterior walls, the minimum size continuous footing shall be 16 inches deep x 24 inches wide.
2. Any continuous wall footing acting as a shear wall foundation shall be specifically designed for that purpose.

1819.2.2 Masonry fences, flower bins, steps and similar decorative structures shall have reinforced concrete foundations designed for all live, dead and wind loads as set forth in Chapter 16 (High-Velocity Hurricane Zones) of this code. The minimum size of these foundations shall be as follows:

Allowable bearing capacity (pounds per square foot)	Unbraced Wall Above Grade (ft)	Minimum Depth and Width[2] (inches)
2,000	Less than or equal to 3 feet	12 x 16
2,000	Greater than 3 feet but less than and including 6 feet	12 x 36
2,000	Greater than 6 feet	None Provided[1]

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 pound per square foot = 47.88 kPa.

NOTES:

1. Foundations for masonry fences, flower bins, steps and similar decorative structures with unbraced heights in excess of six feet shall be based on rational analysis.
2. The minimum continuous footings specified in this section shall be reinforced in accordance with Section 1819.3.

1819.2.3 Based on rational analysis and soil investigation as set forth in Section1818, the footing size or bearing capacity may vary, but the minimum width of a footing under masonry fences, flower bins, steps and similar decorative structures shall not be less than16 inches (406 mm) nor less than 8 inches (203 mm) more than the width of the wall.

Exception: Masonry fences, wing walls and other similar walls that are exposed to lateral wind forces and do not have any lateral restraint above grade, shall have their continuous wall footings placed so the top of footing is no less than 16 inches (406 mm) below grade.

1819.3 The minimum continuous footings specified in this section shall be reinforced as follows:

Reinforcing	Foundation Width
2 # 5	16" and 20" wide
3 # 5	24" and 30" wide
4 # 5	36" wide

1819.3.1 Where footings are 30 inches (762 mm) or more in width, cross bars designed to resist bending at the face of the foundation wall shall be provided.

1819.3.1.1 Equivalent areas in #4 reinforcing bars may be substituted for the sizes as specified in Section 1819.3.

1819.3.1.2 Splices in reinforcing bars shall be not less than 36 bar diameters and reinforcement shall be continuous around all corners and changes in direction. Continuity shall be provided at corners or changes in direction by bending the longitudinal steel around the corner 48 bar diameters or by adding matching reinforcing steel, which shall extend 48 bar diameters from each corner or change in direction When three or more bars are required, the bars shall be held in place and aligned by transverse bars spaced not more than 4 feet (1219 mm) apart.

1819.3.1.3 The reinforcement for footings and other principal structural members in which concrete is deposited against the ground shall have not less than 3 inches (76 mm) of concrete between the reinforcement and the ground contact surface. If concrete surfaces after removal of the forms are to be exposed to the weather or be in contact with the ground, the reinforcement shall be protected with not less than 2 inches (51 mm) of concrete for bars larger than #5 and $1^1/_2$ (38 mm) for #5 or smaller bars.

1819.3.1.4 Excavations for continuous footings shall be cut true to line and grade and the sides of footings shall be formed, except where soil conditions are such that the sides of the excavation stand firm and square. Excavations shall be made to firm, clean bearing soil.

1819.4 Continuous footings shall be placed level and any changes in the grade of such footings shall be made with a vertical tie of the same cross section and design as the footings, or the smaller of the footings, so joined.

1819.4.1 Continuous footings with eccentric loading shall be designed to limit the soil pressure at the edges to within acceptable values by means of counterbalancing or by other approved methods.

1819.4.2 When foundation walls are to be poured separately from the footing, they shall be keyed and doweled to the footing with no less than #4 dowels, 20 diameters in length above and below the joint, spaced not more than 4 feet (1219 mm) apart. Where footing depth does not allow straight dowels, standard hooks will be allowable.

1819.4.3 Concrete footing and pads shall not receive superimposed loads until 12 hours or more after the concrete is placed.

1819.4.4 Excavations for footings and foundations, which are to serve as forms, shall be thoroughly wetted prior to the placement of concrete.

1819.4.5 The top of all continuous footings shall be a minimum of 8 inches (203 mm) below grade.

1819.5 Isolated footings. Dimensions for an isolated footing shall not be less than 12 inches (305 mm) deep and 24 inches square (.02 m^2). Isolated footings in soil having low lateral restraint and isolated piers shall be provided with adequate bracing to resist lateral movement.

1819.5.1 Isolated footings with eccentric loading shall be designed to limit the soil pressure at the edges by means of footing straps or other approved methods.

1819.5.2 When isolated footings support reinforced concrete columns, dowels equivalent in number and area to the column reinforcement and having a length not less than 36 diameters above and below the joint shall be provided in the footing. Where the footing depth precludes straight dowels, standard ACI hooks will be allowable. Such dowels, or anchor bolts as required for steel columns, shall be held to proper grade and location during the pouring of the footing by means of templates or by other approved methods.

1819.5.3 The top of all isolated footings shall be a minimum of 8 inches (203 mm) below grade.

1819.5.4 Any isolated footing subjected to uplift and/or overturning forces shall be specifically designed for that purpose, as set forth in Section 1620.

1819.6 Lateral sliding resistance. The resistance of structural walls to lateral sliding shall be calculated by combining the values derived from the lateral bearing and the lateral sliding resistance shown in Table 1819.6 unless data to substantiate the use of higher values are submitted for approval. For clay, sandy clay and clayey silt, in no case shall the lateral sliding resistance exceed one-half the dead load.

1819.6.1 Increases in allowable lateral sliding resistance. The resistance values derived from the table may be increased by the tabular value for each additional foot of depth to a maximum of 15 times the tabular value. Isolated poles for uses such as flagpoles or signs and poles used to support buildings which are not adversely affected by 1/2-inch (12.7 mm) motion at the ground surface because of short-term lateral loads may be designed using lateral bearing values equal to two times the tabular values.

1819.7 Designs employing lateral bearing. Designs to resist lateral loads employing posts or poles as columns embedded in earth or embedded in concrete footings in the earth shall conform to the requirements of Sections 1819.7.1 through 1819.7.2.1.

1819.7.1 Limitation. Posts embedded in earth shall not be used to provide lateral support for structural or non structural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

1819.7.2 Design criteria. The depth to resist lateral loads shall be determined by the design criteria in Sections1819.7.2.1 through 1819.7.2.2 or by other methods approved by the building official.

1819.7.2.1 Unconstrained. The following formula shall be used in determining the depth of embedment required to resist the lateral loads where no constraint is provided at the ground surface, such as a structural diaphragm.

$$d = 0.5A\{1 + [1 + (4.36h/A)]1/2\}$$

Where:

$$A = 2.34P/(S_1 b)$$

b = diameter of round post or diagonal dimension of square post or footing, feet.

d = depth of embedment in earth in feet but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = distance in feet from ground surface to point of application of P.

P = applied lateral force, pounds.

S_1 = Allowable lateral soil-bearing pressure as set forth in Table 1819.6 based on a depth of one-third the depth of embedment, pounds per square foot.

S_3 = Allowable lateral soil-bearing pressure as set forth in Table 1819.6 based on a depth equal to the depth of embedment, pounds per square foot.

1819.7.2.2 Constrained. The following formula shall be used in determining the depth of embedment required to resist the lateral loads where constraint is provided at the ground surface, such as a rigid floor or rigid ground surface pavement.

$$d^2 = 4.25(Ph/S_3 b)$$

or alternately

$$d^2 = 4.25(M_g/S_3 b)$$

Where:

M_g = Moment in the post at grade, foot-pounds.

TABLE 1819.6
ALLOWABLE LATERAL PRESSURE

CLASS OF MATERIALS	LATERAL BEARING (psf/ft BELOW NATURAL GRADE)	LATERAL SLIDING	
		Coefficient of Friction (a)	Resistance (psf)(b)
1. Sedimentary and foliated rock	400	0.35	
2. Sandy gravel and/or gravel	200	0.35	
3. Sand, silty sand, clayey sand, silty gravel land clayey gravel	150	0.25	
4. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt	100		130

For SI: 1 pound per square foot = 47.88 Pa.

NOTES:

a. Coefficient to be multiplied by the dead load.

b. Lateral sliding resistance to be multiplied by the contact area, as limited by Section 1819.6.

SECTION 1820
HIGH-VELOCITY HURRICANE ZONES—
CONCRETE SLABS ON FILL

1820.1 Concrete floors placed directly on the supporting soil shall comply with this section.

1820.2 Where it is proposed to place concrete slabs directly on the supporting soil, a subgrade shall be thoroughly compacted by approved methods. All fill placed under slabs shall be clean sand or rock, free of debris and other deleterious materials. The maximum size of rock within 12 inches (305 mm) below the floor slab in compacted fill shall be 3 inches (76 mm) in diameter. Where fill material includes rock, large rocks shall not be allowed to nest and all voids shall be carefully filled with small stones or sand, and properly compacted.

1820.3. Concrete floor slabs placed directly on the supporting soil shall be a minimum of 4 inches (102 mm) in thickness, reinforced with not less than 0.028 square inches (18 mm2) of reinforcing per linear foot of slab in each direction.

1820.3.1 Fill supporting such slabs shall be compacted under the supervision of a special inspector to a minimum of 95 percent of maximum dry density for all layers, as verified by field density tests specified in Section1820.3.2.

1820.3.2 Tests shall be made in accordance with Methods of Test for Moisture Density Relations of Soils, ASTM D 1557 modified to use 25 blows on five layers with a 10-pound (5 kg) hammer dropping 18 inches (457 mm). In addition, a minimum of one in-place field density test shall be performed for each 2,500 square feet (232 m2), or fraction thereof, for each lift of compacted soil, and such testing shall be performed in accordance with either ASTM D 1556, Standard Test Method for Density of Soil In-Place by the Sandcone; or ASTM D 2922, Standard Test Methods for Density of Soil and Soil Aggregate in-place by Nuclear Methods (Shallow Depth), or other approved methods.

1820.3.3 Where a concrete slab is supported by a foundation wall or continuous footing, the effect of the support shall be considered in the design.

1820.3.4 All concrete slab edges and concrete beams supporting exterior walls shall be recessed a minimum of $^3/_4$ inch (19 mm) below top of slab for a width of the exterior wall, or provided with an alternate water-stop method approved by the building official.

1820.3.5 The discontinuous edges of all slabs surrounding swimming pools and floor slabs for screen patios and utility sheds shall be at least a minimum of 8 inches (203 mm) deep and 8 inches (203 mm) wide and shall be reinforced with one continuous #5 bar.

1820.3.6 Reinforced concrete slabs on fill for garbage containers shall be a minimum of 1 foot (305 mm) larger on all sides than the garbage receptacle (dumpster) and a minimum thickness of 6 inches (152 mm).

1820.4 When polyethylene sheets are used as a vapor barrier beneath a ground floor slab, the subgrade for that slab shall be considered a formed surface for the purpose of reinforcing steel coverage.

1820.5 Concrete slabs outside of buildings, other than patios and pool slabs, where placed directly on the supporting soil, for minor accessory uses such as, but not limited to, walkways, driveways, minor equipment pads, etc, shall be not less than 4 inches (102 mm) thick. Such slabs shall be placed on clean, thoroughly compacted sand or crushed rock free from organics, debris or other deleterious materials.

SECTION 1821
HIGH-VELOCITY HURRICANE ZONES—
MONOLITHIC FOOTINGS

1821.1 Monolithic footings under walls shall be continuous or continuity otherwise provided and shall be not less than required to keep the soil pressure within that set forth in Section 1818 nor less than the following minimums:

Allowable bearing capacity (Pounds per square foot)	No. of Stories	Minimum Depth and Width[2] (inches)
2000	1	12 x 16[1]
2000	2	12 x 24

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 47.88 Pa.

Based on rational analysis and soil investigation as set forth in Section 1818, the footing size or bearing capacity may vary, but the minimum width of a footing under the main walls of the buildings shall not be less than 16 inches nor less than 8 inches more than the width of the foundation wall.

NOTES:

(1) For single story wood frame exterior walls, the minimum size continuous footing shall be 16 inches deep x 24 inches wide.

(2) Any continuous wall footing acting as a shear wall foundation shall be specifically designed for that purpose.

1821.1.1 A minimum outside finish grade of 8 inches (203 mm) above the bottom of the exterior monolithic footing shall be required, but in no case shall the outside finish grade be above the top of the finish slab surface unless sufficient means to minimize moisture intrusion into the structure have been provided to the satisfaction of the building official.

1821.1.2 Continuous monolithic footings shall be placed level and any change in the grade of such footings shall be made with a step of the same cross section and design as the monolithic footings, or the smaller of the monolithic footings, so joined.

1821.1.3 Continuous monolithic footings with eccentric loading shall be designed to limit the soil pressure at the edges to within acceptable values by means of counterbalancing or by other approved methods.

1821.1.4 Concrete monolithic footings and pads shall not receive superimposed loads until 12 hours or more after the concrete is placed.

1821.1.5 Excavations for monolithic footings and foundations, which are to serve as forms, shall be thoroughly wet prior to placing concrete.

1821.1.6 Monolithic foundation systems shall be limited for the support of a maximum of two stories and/or floors or a maximum mean roof height of 25 feet (7620 mm) above grade unless the monolithic foundation system has been designed by a professional engineer and ample consider-

ation has been given to the eccentric loading, foundation rotation and shear cracking at the slab/foundation interface.

1821.1.7 The minimum continuous monolithic footings specified in this section shall be reinforced as follows:

Reinforcing	Minimum Width Foundation (in.)
2 # 5	16" and 20" wide
3 # 5	24" and 30" wide
4 # 5	36" wide

For SI: 1 inch = 25.4 mm.

1821.1.8 Where footings are 30 inches (762 mm) or more in width, cross bars designed to resist bending at the face of the foundation wall shall be provided.

1821.1.9 Equivalent areas in #4 reinforcing bars may be substituted for the sizes as specified in Section 1821.1.7.

1821.1.10 Splices in reinforcing bars shall be not less than 36 bar diameters and reinforcement shall be continuous around all corners and changes in direction. Continuity shall be provided at corners or changes in direction by bending the longitudinal steel around the corner 48 bar diameters or by adding matching reinforcing steel, which shall extend 48 bar diameters from each corner or change in direction. When three or more bars are required, the bars shall be held in place and alignment by transverse bars spaced not more than 4 feet (1219 mm) apart.

1821.1.11 The reinforcement for monolithic footings and other principal structural members in which concrete is deposited against the ground shall have not less than 3 inches (76 mm) of concrete between the reinforcement and the ground contact surface. If concrete surfaces after removal of the forms are to be exposed to the weather or be in contact with the ground, the reinforcement shall be protected with not less than 2 inches (51 mm) of concrete for bars larger than #5 and $1^1/_2$ inches (38 mm) for #5 or smaller bars.

1821.1.12 Excavations for continuous monolithic footings shall be cut true to line and grade and the sides of footings shall be formed, except where soil conditions are such that the sides of the excavation stand firm and square. Excavations shall be made to firm, clean bearing soil.

1821.1.13 Unless otherwise determined by rational analysis, monolithic footings shall have transfer reinforcement along the perimeter of the foundation. Said reinforcement shall be no less than #4 reinforcing steel bars spaced no greater than 12 inches (305 mm) on center and shall be no less than 5 feet (1524 mm) in length plus a standard ACI hook and shall be placed to transfer into the slab section commencing at a point no less than 3 inches (76 mm) from the edge form.

SECTION 1822
HIGH-VELOCITY HURRICANE ZONES—PILE FOUNDATIONS

1822.1 Pile foundations shall be designed and installed on the basis of a geotechnical exploration which shall include field and/or laboratory tests.

1822.1.1 Piles used for the support of any building or structure shall be driven to a resistance and penetration in accordance with the plans and/or specifications as set forth herein.

1822.1.2 Piles may be jetted under the supervision of a professional engineer. Immediately after completion of jetting, piles shall be driven below the depth jetted to the required resistance, but not less than 1 foot (305 mm), or to nominal refusal whichever comes first. No jetting will be permitted that may be detrimental to existing adjacent structures or piles that have been driven.

1822.1.3 When isolated columns, piers and other loads are supported on piles, a minimum of three piles shall be used for such support unless lateral bracing is provided at the pile cap to insure stability. Should a pile group be loaded eccentrically so as to produce an overload on any pile more than 10 percent of the allowable load, footing straps or other approved methods shall be required to counteract the effect of eccentric loading.

1822.1.4 The minimum center-to-center spacing of piles shall be not less than twice the average diameter of round piles or $1^3/_4$ times the diagonal dimensions of rectangular piles but in no case less than 30 inches (762 mm). Piles supporting structural walls shall have dowels installed to offer sufficient resistance for lateral restraint of a grade beam.

1822.1.5 Nonfluid soil shall be considered as providing full lateral support against column action. The portion of a pile that extends through air, water, fluid soil or other unstable material shall be designed as a structural column. Soils having a consistency stiffer than fluid soil may be considered as capable of providing lateral support. Where cast-in-place piles are used reinforcement shall extend 10 feet (3048 mm) below the plane where the soil provides lateral restraint. Sufficient reinforcement for all types of piles shall be provided at the junction of the pile and pile cap or grade beam to make a suitable connection. Shells conforming to Section 1826.1 may be considered as reinforcement.

1822.1.6 Reinforced concrete caps shall be provided for all pile clusters and such caps shall extend laterally not less than 6 inches (152 mm) beyond the extreme pile surface and vertically not less than 4 inches (102 mm) below the pile butt. Pile caps may be omitted when piles are used to support grade beams, provided that the spacing of Section 1822.1.4 is complied with, and provided that the portions of the grade beams acting in place of the pile cap shall be computed by a recognized method of analysis to properly carry the loads.

1822.1.7 Piles shall be driven using an approved cushion block consisting of material arranged to provide transmission of hammer energy equivalent to one-piece hardwood with the grain parallel to the axis of the pile and enclosed in a metal housing to prevent its lateral deformation between the hammer ram and the top of the pile.

1822.1.8 Friction piles shall be driven to a minimum penetration of 12 feet (3658 mm) below the cutoff or the existing ground, whichever is the lower.

1822.1.9 Diesel hammers may be used for driving piles if provided with one of the following means of determining the energy of the hammer's blow.

1822.1.10 Closed-top diesel hammers shall be used with a rating instrument and charts to measure the equivalent WH energy per blow of the hammer. The equivalent WH energy as measured by the instrument shall be the ram's weight times the equivalent ram plus an added value obtained from the energy stored in the bounce chamber. The energy per blow shall be the equivalent WH energy for the closed-top diesel.

1822.1.11 Open-top diesel hammers shall be equipped with a ram stroke indictor rod that is striped in increments above the hammer body and fastened to the body of the hammer. The energy per blow for the open top diesel shall be computed as the ram's working stroke times the ram's weight.

1822.1.12 The load-bearing formula applicable for single-acting pile hammers shall be used to compute the bearing capacity of the driven pile.

1822.1.13 Followers shall be used only upon permission of the special inspector or engineer and only where necessary to effect installation of piles. A follower shall be of a size, shape, length, material and weight to permit driving the pile in the desired location and to the required depth and resistance without loss of hammer energy in the follower.

1822.1.14 Splices shall be avoided as far as practicable. Splices shall be constructed to provide and maintain true alignment and position of the component parts of the pile during installation and subsequent thereto. Splices shall develop the required strength of the pile.

1822.1.15 The safe capacity of a group of friction piles in plastic material may be determined by load testing the group to 150 percent of the proposed group load or by the formula given in Section 1822.2. When computed by formula, the allowable load for such a group shall be the allowable load for one pile times the number of piles in the group times the efficiency of the pile group determined as follows:

$$E = 1 - 0\frac{(N-1)M + (M-1)N}{90MN}$$

Where:

E = is the efficiency

S = the average spacing of the piles, inches

M = the number of rows

N = the number of piles in one row

D = the average diameter of the pile, inches

O = arc tan D/S, in degrees

1822.1.16 Types of piles that are not provided for in this section shall conform to the requirements herein for the type that it most nearly approximates, subject to such additional requirements as may be made by the building official.

1822.1.17 Pile driving hammers shall develop a minimum of 1 foot-pound of energy per pound of pile or mandrel, but not less than 7,000 foot-pounds of energy per blow.

1822.1.18 Piles may be driven with drop or gravity hammers provided the hammer shall weigh not less than 3,000 pounds (1362 kg) and the fall of the hammer shall not exceed 6 feet (1829 mm).

1822.1.19 Piles shall be driven with a variation of not more than $^1/_4$ (6 mm) inch per foot from the vertical, or from the batter line indicted, with a maximum variation of the head of the pile from the position shown on the plans of not more than 3 inches (76 mm), subject to the provisions of Section 1822.1.3.

1822.1.20 The special inspector or engineer supervising the pile driving operations shall be required to keep an accurate record of the material and the principal dimensions of each pile; of the weight and fall of the hammer, if a single-acting hammer or drop hammer; the size and make, operating pressure, length of hose, number of blows per minute and energy per blow, if a double-acting hammer; together with the average penetration of each pile for at least the last five blows, and the grades at tip and cut-off. A copy of these records shall be filed with the building official and kept with the plans.

1822.1.21 Where piling must penetrate strata offering high resistance to driving or where jetting could cause damage, the inspector or supervising engineer may require that the piles be set in predrilled or punched holes. The equipment used for drilling or punching must be approved by the special inspector or engineer, and provided that all piles shall reach their final penetration by driving.

1822.1.22 The maximum load permitted on any driven pile shall not exceed 36 tons unless substantiated by a load test performed at the site, as set forth in Section 1829.

1822.1.23 The building official may require tests on any pile where performance is questionable.

1822.1.24 Piles shall be designed and driven to develop not less than 10 tons safe bearing capacity.

1822.1.25 In soils in which the installation of piles causes previously installed piles to heave, accurate level marks shall be put on all piles immediately after installation and all heaved piles shall be reinstalled to the required resistance.

1822.1.26 Piles shall not be driven closer than 2 feet (610 mm) nor jetted closer than 10 feet (3048 mm) to an existing building or structure unless approved by a special inspector or engineer.

1822.2 Driving formula load. Subject to pile load limitations contained in Sections 1823.1.8 and 1824.1.2 and in the absence of pile load test data satisfactory to the building official, the load on a pile shall not exceed that computed from the following driving formula:

Drop Hammer: $$P = \frac{2Wh}{S+1}$$

Single Acting Hammers: $$P = \frac{2Wh}{S+0.1}$$

Double Acting Hammers: $P = \frac{2(W + Ap)^h}{S + 0.1}$

Or differential in which:

A = area of piston, square inches

p = pressure at the hammer, pounds per square inch

P = allowable total load, pounds

W= weight of striking part of hammer, pounds

H=height of fall of striking part of hammer, feet, or stroke, feet

S = average penetration per blow of not less than the five final blows

SECTION 1823
HIGH-VELOCITY HURRICANE ZONES—WOOD PILES

1823.1 Woodpiles shall conform to ASTM D 25, Round Timber Piles.

1823.1.1 Untreated wood piles in all cases shall be cut off not higher than mean low water table and shall be capped with concrete.

1823.1.2 Timber piles used to support permanent structures shall be treated in accordance with this section unless it is established that the top of the untreated timber piles will be below lowest ground water level assumed to exist during the life of the structure.

1823.1.3 Preservative and minimum final retention shall be in accordance with AWPA C3.

1823.1.4 When timber piles are used in salt water, the treatment shall conform to AWPA MP-1, MP-2 or MP-4. Pile cutoffs shall be treated in accordance with AWPA M-4.

1823.1.4.1 All preservative-treated wood piles shall have a metal tag, brand or other preservative treatment identification mark.

1823.1.4.2 Such mark shall identify the producer, and/or the appropriate inspection agency, and treatment specifications or quality mark.

1823.1.5 Wood piles which support a structure over water may project above the water to such height as may be necessary for structural purposes, provided that such piles used to support structures other than open wharves, boat landings, and other similar light structures shall have been treated in accordance with Section 1823.1.2

1823.1.6 Wood piles shall be driven with a protective driving cap or ring when necessary to prevent brooming or splitting of the butt. When brooming or splitting occurs, such piles shall be cut back to solid wood before the final resistance to penetrations is measured.

1823.1.7 If required, when driving through or to hard material or to rock, wood piles shall be fitted with a metal protective driving cap shown satisfactory to the building official.

1823.1.8 The maximum allowable load on a round timber pile shall be determined in accordance with Section 1822.1.22, provided the maximum allowable stresses of timber are not exceeded.

1823.1.8.1 The allowable stresses for timber piles shall not exceed the values in Table 1823 except as modified by Part 6 of the National Design Specification for Wood Construction.

SECTION 1824
HIGH-VELOCITY HURRICANE ZONES—PRECAST CONCRETE PILES

1824.1 Precast concrete piles shall be cast of concrete having a compressive strength of not less than 3,000 pounds per square inch (psi) (21 MPa) at the time of driving, and shall be reinforced with a minimum of four longitudinal steel bars having an area of not less than 1 percent nor more than 4 percent of the gross concrete area. All longitudinal bars shall be of uniform size and shall be tied by not less than #2 hoops spaced 8 inches (203 mm) in the body of the pile and not over 3 inches (76 mm) for the first 18 inches (437 mm) from both the butt and the tip.

TABLE 1823

SPECIES	COMPRESSION PARALLEL TO GRADE (psi)[4]	BENDING (psi)[4]	SHEAR HORIZ (psi)[4]	COMP PERP TO GRAIN (psi)[4]	MODULUS OF ELASTICITY
Pacific Coast Douglas Fir[1]	1,250	2,450	115	230	1,500,000
Southern Pine[2]	1,200	2,400	110	250	1,500,000
Red Oak[3]	1,100	2,450	135	350	1,250,000
Red Pine[4]	900	1,900	85	155	1,280,000

For SI: 1 pound per square inch = 0.0068 MPa.

1. Pacific Douglas Coast Fir values apply only to species as defined in ASTM Designation 01760-76, Standard Specification for Pressure Treatment of Timber Products. For faster design, use Douglas Fir-Larch design values.
2. Southern Pine values apply to Longleaf, Slash, Loblolly and Short Leaf Pines.
3. Red Oak values apply to Northern and Southern Red Oak.
4. Red Pine values apply to Red Pine grown in the United States.

All reinforcement shall be protected by 2 inches (51 mm) or more of concrete, except that for piles subjected to the action of open water, waves or other severe exposure, a 3-inch (76 mm) protective covering shall be furnished in the zone of such exposure. For point bearing piles, the concrete area of the tip shall be not less than 75 percent of the area of the butt.

1824.1.1 All precast concrete piles shall have their date of manufacture and the lifting points clearly marked on the pile. Concrete piles shall not be driven until they have attained their full specification strength as verified by tests, nor shall the piles be removed from the forms until 50 percent of the specification strength has been attained. Piles shall not be transported nor driven until they have been cured not less than seven days for Type I cement and three days for Type III cement.

1824.1.2 In the absence of load tests, the maximum allowable load per pile shall not exceed the values set forth in Table 1824.

TABLE 1824

SIZE (INCHES)	MAXIMUM LOAD (TONS)
10 x 10	17
12 x 12	25
14 x 14	35

For SI: 1 inch = 25.4 mm.

SECTION 1825
HIGH-VELOCITY HURRICANE ZONES — PRESTRESSED PRECAST CONCRETE PILES

1825.1 Prestressed precast concrete piles shall conform to Chapter 19 (High-Velocity Hurricane Zones) and to Sections 1822.1.1, 1822.2, 1824 and 1828 except as specifically detailed in this section.

1825.1.1 Prestressed concrete piles shall be cast of concrete having a compressive strength of not less than 5,000 psi (34 MPa) at time of driving and 3,000 psi (21 MPa) before transfer of the prestressing force. The prestressing elements shall not be stressed initially in excess of 75 percent of ultimate strength. The elements shall transfer a compressive stress to the concrete, after losses, of not less than 0.08 percent of the specified strength at driving. Under loads other than handling no tension will be permitted in the concrete.

1825.1.2 Longitudinal reinforcing shall be protected by 2 inches (51 mm) of concrete and shall be tied by #2 hoops or #5 AS&W gauge spirals spaced at 8 inches (203 mm) in the body of piling 14 inches (356 mm) or smaller or 9 inches (22 mm) in the body of piling 16 inches (76 mm) or larger and not over 3 inches (76 mm) for the first 18 inches (457 mm) from both the butt and the tip.

SECTION 1826
HIGH-VELOCITY HURRICANE ZONES— CAST-IN-PLACE

1826.1 Cast-in place concrete piles shall consist of a steel shell driven in intimate contact with the surrounding soil and left in place and filled with concrete. Steel shells may be uniformly tapered, step-tapered, cylindrical or a combination of such shapes and may be laterally corrugated, spirally corrugated, longitudinally fluted or plain.

1826.1.1 Pile shells and end closures shall be of sufficient strength and rigidity to permit their driving in keeping with the driving method used, and to prevent harmful distortion caused by soil pressures or the driving of adjacent piles until filled with concrete. A reduction of cross sectional area in excess of 15 percent shall be cause for rejection. The shells shall also be sufficiently water tight to exclude water during the placing of concrete.

1826.1.2 The minimum diameter shall be 8 inches.

1826.1.3 Concrete for cast-in-place piles shall develop a compressive strength of not less than 3,000 psi (21 MPa) in 28 days. The concrete shall be deposited in a continuous operation to insure a full-sized pile without voids or separation. Concrete shall be placed in the dry. The pile may be sealed by depositing concrete by tremie or other approved method.

1826.1.4 Splices of shell sections shall be designed to insure the alignment of the shells and develop the full strength of the shell station.

1826.1.5 The load on the shell shall not exceed 25 percent of the minimum average tensile yield strength of the steel multiplied by the area of the shell.

1826.1.5.1 Shells having a wall thickness of 0.119 inch (3 mm) or more may be considered as carrying part of the load.

1826.1.5.2 Adequate allowance for corrosion shall be considered in the design but not less than the outer inch of the shell thickness shall be deducted before computing the area of the shell considered as carrying load.

1826.1.5.3 The metal for the shells shall conform to the Standards of Welded and Seamless Steel Pipe Piles, Grade 2, ASTM A 252, for Hot-Rolled Carbon Steel Sheets and Strip of Structural Quality, ASTM A 570 and Carbon Structural Steel, Cold-Rolled Sheet, ASTM A 611.

1826.1.5.4 The yield strength used in design shall be that of the material in the fabricated shell.

1826.1.6 For friction piles, the allowable load shall be computed at the cross section located at a point two-thirds of the embedded length of the pile, in material providing suitable lateral support, measured upward from the tip. The load on the concrete shall not exceed 25 percent of the 28-day strength of the concrete multiplied by the concrete area.

1826.1.7 For end-bearing piles, the concrete area of the critical section shall be such that the unit stress on the concrete does not exceed 0.25 f'c under the pile load. The area of the shell and the critical section of the concrete shall be taken at the elevation where the pile enters the stratum furnishing and bearing.

SECTION 1827
HIGH-VELOCITY HURRICANE ZONES — ROLLED STRUCTURAL SHAPES

1827.1 Rolled structural steel piles shall conform to the Standards for general requirements for Hot-Rolled and Cold-Finished Carbon and Alloy Steel Bars, ASTM A 29, and Carbon Steel Bars Subject to Mechanical Property Requirements, ASTM A 306, except that copper may be added to increase the corrosion-resistant properties of the material.

1827.1.1 Sections of such pile of H form shall have flange projections not exceeding 14 times the thickness of web or flange and total flange width not less than 85 percent of the depth of the section.

1827.1.2 No section shall have a nominal thickness of metal less than $^3/_8$ inch (10 mm).

1827.1.3 For end-bearing piles, the allowable stress may be determined on the basis of an allowable stress of 25 percent of the yield value of the steel.

1827.1.4 In the absence of adequate corrosion protection, $^1/_{16}$ inch (1.6 mm) shall be deducted from each face in determining the area of the pile section.

1827.1.5 The allowable load, when used as friction piles, shall be determined by load tests at the site.

SECTION 1828
HIGH-VELOCITY HURRICANE ZONES — SPECIAL PILES OR SPECIAL CONDITIONS

1828.1 The use of types of piles or conditions not specifically covered herein may be permitted, subject to the approval of the building official, upon submission of acceptable test data, calculations or other information relating to the properties and load-carrying capacity of such piles.

SECTION 1829
HIGH-VELOCITY HURRICANE ZONES— LOAD TESTS ON PILES

1829.1 Single piles tested shall be loaded to at least twice the desired design load and should pile groups be tested, the test load shall be not less than $1^1/_2$ times the total desired load for the group.

1829.1.1 The apparatus for applying known vertical loads to the top of the pile shall maintain constant load under increasing settlement, and shall apply the loads in such a way that no lateral forces or impact will occur. Hydraulic jacks when used shall be equipped with a calibrated pressure gauge. Uplift piles used to provide the jacking resistance shall be a sufficient distance from the test pile so as not to influence its behavior under test.

1829.1.2 The test load shall be applied in increments of not more than 25 percent of the design load until the total test load has been applied.

1829.1.3 The method for determining vertical movement shall be subject to the approval of the building official. Readings shall be sufficient in number to define the time settlement and rebound curve.

1829.1.4 Each load increment shall be maintained for a minimum of 1 hour, and until the rate of settlement is less than 0.01 inch (.25 mm) per hour. The total load shall be maintained until settlement does not exceed 0.01 (.25 mm) inch in 24 hours. Settlement readings shall be taken at regular intervals during the test period.

1829.1.5 After the maximum load has remained on the pile for 24 hours and final settlement readings have been taken, the pile shall be unloaded in 50-percent decrements of design load. Rebound readings shall be taken at regular intervals during the unloading period, and final reading taken approximately 12 hours after the entire load has been removed.

1829.1.6 The maximum allowable pile load shall be one-half of that load which causes a net settlement of not more than 0.005 inch (.13 mm) per ton of test load, a gross settlement of 1 inch (25 mm) (whichever is less) or a disproportionate increase in settlement.

1829.1.7 Control test piles shall be tested in accordance with ASTM D 1143, Method of Testing Piles Under Axial Compressive Load. If quick load test procedures are used, the applied test load shall be not less than three times the working pile capacity and in accordance with the standard.

SECTION 1830
HIGH-VELOCITY HURRICANE ZONES — FOUNDATION WALLS AND GRADE BEAMS

1830.1 Exterior foundation walls of buildings, where the character of the soil is such that allowable soil loads of 1,500 pounds per square foot (psf) (81 kN/m^2) or less are used for design, shall be poured-in-place reinforced concrete from the footing to the bottom of the first or ground floor construction.

1830.1.1 Exterior foundation walls of building, where the character of the soil is such that allowable soil loads of more than 1,500 psf (71 kN/m^2) are used for design, may be of unit masonry or concrete on continuous concrete footings.

1830.1.2 Under the exterior walls of buildings of Type V construction, in locations where extreme dampness exists, the building official may approve isolated piers, provided such piers are as otherwise set forth in Section 1823.1.1.

1830.2 Detailed requirements.

1830.2.1 The thickness of the foundation wall shall be not less than 8 inches (203 mm).

1830.2.2 Where wood joist construction is used for the first or ground floor, the thickness of the exterior foundation walls shall be not less than 8 inches (203 mm), plus 4 inches (102 mm) for the bearing of joists.

1830.2.3 Foundations of unit masonry supporting joists shall be capped with 4 inches (102 mm) of concrete.

1830.3 Interior bearing walls. Interior foundation walls shall be of the material and design as specified in Section1830.1 except as follows.

1830.3.1 Interior foundation walls that support stud walls shall be exempted from the additional 4 inches (102 mm) of width required for the bearing of joists.

1830.3.2 The use of isolated piers, girders and beams may be substituted for interior foundation walls when designed by a registered architect and/or engineer.

1830.4 Grade beams.

1830.4.1 Grade beams supporting loads between piles or piers shall be reinforced concrete or structural steel protected by 2 inches (51 mm) of concrete cover.

1830.4.2 Grade beams shall be the thickness of the wall they support but never less than 8 inches (203 mm) nor less than set forth for foundation walls herein.

1830.4.3 Grade beams shall be suitably designed and reinforced around access openings and vents.

SECTION 1831
HIGH-VELOCITY HURRICANE ZONES — GRADES UNDER BUILDINGS

1831.1 The grade of the ground under buildings of joist or suspended slab construction having no basements shall not be lower than the lowest surrounding finished lot area grade in order to prevent the accumulation and standing of ground, storm or tide water under such buildings unless provided with other approved means of drainage.

1831.1.1 Plans for future raising of lots shall be taken into account in planning the grade of the ground under such buildings.

1831.1.2 The building official may establish grades under such buildings based on present or future street or sidewalk grades abutting the property.

SECTION 1832
HIGH-VELOCITY HURRICANE ZONES— RETAINING WALLS

1832.1 All walls exceeding 24 inches (610 mm) in height built to retain or support earth, or subject to pressure from adjoining earth, and any surcharge shall be designed to resist the pressure to which they are subjected, including water pressure that may exist.

SECTION 1833
HIGH-VELOCITY HURRICANE ZONES— SEAWALLS AND BULKHEADS

1833.1 All dredging, filling, excavation and waterfront construction such as docks, piers, wharves, bridges, groins, jetties, moles, breakwaters, seawalls, revetments, causeways, artificial nourishment of beaches or other deposition or removal of material in all water areas within the area of jurisdiction of this code shall be planned and designed by a professional engineer, except as noted in Section 1833.2, in accordance with this code and the applicable standards and requirements of the administrative authority.

1833.2 The requirement for professional design will not be required by the building official for bulkheads, docks, piers and similar structures constructed in conjunction with private residences on lakes, private canals and similar water frontage not subject to wind, wave or tidal action; do not involve unusual soil conditions, slopes or unstable soil and are not part of a foundation or support for an above-grade structure.

SECTION 1834
HIGH-VELOCITY HURRICANE ZONES— SOIL IMPROVEMENT

1834.1 The application of soil improvement techniques shall comply with this section.

1834.1.1 Methods of soil improvement for a specific site shall be determined by a registered professional engineer, hereinafter referred to as the geotechnical engineer, and such methods shall provide for field testing as required herein.

1834.1.2 A permit shall be required prior to the commencement of any soil improvement, and no building permit shall be issued until it has been determined that adequate bearing capacity has been obtained for the foundation, and the requirements of this section have been satisfied.

1834.2 Limits on application.

1834.2.1 Soil improvement shall not be permitted where subsurface conditions consist of zones of organic materials of sufficient quality above or below the ground water table which cannot be dispersed or displaced to levels not exceeding 5-percent dry weight of organic content in any undisturbed sample.

1834.2.2 Dynamic compaction, vibrocompaction, preloading, surcharging or other similar methods of soil improvements shall not be permitted near or within coastal areas subject to storm surge, scour or other forms of water erosion without suitable protection provided for the building foundation.

1834.3 Required testing.

1834.3.1 A rational program of field tests and soil analyses shall be part of the soil improvement treatment.

1834.3.2 Such tests shall determine the soil characteristics after treatment, and the results of the tests shall demonstrate whether the subsurface improvement has increased the bearing capacity of the soil to that which is capable of safely supporting the proposed construction.

1834.3.3 The testing shall be performed in accordance with the provisions of ASTM D 1586, Standard Penetration Test; ASTM D 3441, Static Cone Soundings; or by Menard Pressuremeter; Dilatometer or other on-site tests recognized by the industry.

1834.3.4 The test results shall be used to determine the achieved bearing capacity and the anticipated settlement.

1834.4 Requirements for acceptance. The efficacy of any application of soil improvement techniques shall be verified by appropriate calculations, testing and documentation as required in this section.

1834.4.1 All organics, including any organic lens, shall be displaced by the injection of sand or other suitable fill material, or otherwise dispersed in accordance with the provisions of this section, to levels not exceeding 5 percent by weight of organic content in any undisturbed sample.

1834.4.2 Complete documentation of required tests shall be required, and shall included as a minimum, but shall not be limited to:

1. A description of the stratigraphy and densification required and
2. Foundation bearing capacity and settlement analysis performed by an independent testing laboratory.
3. The anticipated settlement potential under superimposed loads shall be acknowledged and accepted by the engineer of record in writing prior to issuance of a building permit.
4. The results of testing to determine subsurface conditions shall be retained by the geotechnical engineer and submitted to the building official upon request.

CHAPTER 19
CONCRETE

Italics are used for text within Sections 1903 through 1908 of this code to indicate provisions that differ from ACI 318.

SECTION 1901
GENERAL

1901.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 1917 and 1919 through 1929.

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1908 of this code. Except for the provisions of Sections 1904 and 1910, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical loads or lateral forces from other parts of the structure to the soil.

1901.3 Source and applicability. The format and subject matter of Sections 1902 through 1907 of this chapter are patterned after, and in general conformity with, the provisions for structural concrete in ACI 318.

1901.4 Construction documents. The construction documents for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement, and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints specified for plain concrete.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for posttensioning tendons.
11. Reserved.

1901.5 Special inspection. Reserved.

SECTION 1902
DEFINITIONS

1902.1 General. The words and terms defined in ACI 318 shall, for the purposes of this chapter and as used elsewhere in this code for concrete construction, have the meanings shown in ACI 318.

SECTION 1903
SPECIFICATIONS FOR TESTS AND MATERIALS

1903.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318. *Where required, special inspections and tests shall be in accordance with Chapter 17.*

1903.2 Glass fiber reinforced concrete. *Glass fiber reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI MNL 128 standard.*

SECTION 1904
DURABILITY REQUIREMENTS

1904.1 Water-cementitious materials ratio. Where maximum water-cementitious materials ratios are specified in ACI 318, they shall be calculated in accordance with ACI 318, Section 4.1.

1904.2 Freezing and thawing exposures. Concrete that will be exposed to freezing and thawing, deicing chemicals or other exposure conditions as defined below shall comply with Sections 1904.2.1 through 1904.2.3.

1904.2.1 Air entrainment. Concrete exposed to freezing and thawing or deicing chemicals shall be air entrained in accordance with ACI 318, Section 4.2.1:

1904.2.2 Concrete properties. Concrete that will be subject to the following exposures shall conform to the corresponding maximum water-cementitious materials ratios and minimum specified concrete compressive strength requirements of ACI 318, Section 4.2.2:

1. Concrete intended to have low permeability where exposed to water;
2. Concrete exposed to freezing and thawing in a moist condition or deicer chemicals; or
3. Concrete with reinforcement where the concrete is exposed to chlorides from deicing chemicals, salt, salt water, brackish water, seawater or spray from these sources.

Exception: *For occupancies and appurtenances thereto in Group R occupancies that are in buildings less than four stories in height, normal-weight aggregate concrete shall comply with the require-*

ments of Table 1904.2.2 based on the weathering classification (freezing and thawing) determined from Figure 1904.2.2.

In addition, concrete exposed to deicing chemicals shall conform to the limitations of Section 1904.2.3.

1904.2.3 Deicing chemicals. For concrete exposed to deicing chemicals, the maximum weight of fly ash, other pozzolans, silica fume or slag that is included in the concrete shall not exceed the percentages of the total weight of cementitious materials permitted by ACI 318, Section 4.2.3.

TABLE 1904.2.2
MINIMUM SPECIFIED COMPRESSIVE STRENGTH (f'_c)

TYPE OR LOCATION OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH (f'_c at 28 days, psi)		
	Negligible exposure	Moderate exposure	Severe exposure
Basement walls[c] and foundations not exposed to the weather	2,500	2,500	2,500[a]
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500[a]
Basement walls[c], foundation walls, exterior walls and other vertical concrete surfaces exposed to the weather	2,500	3,000[b]	3,000[b]
Driveways, curbs, walks, patios, porches, carport slabs, steps and other flatwork exposed to the weather, and garage floor slabs	2,500	3,000[b, d]	3,500[b, d]

For SI: 1 pound per square inch = 0.00689 MPa.

a. Concrete in these locations that can be subjected to freezing and thawing during construction shall be of air-entrained concrete in accordance with Section 1904.2.1.

b. Concrete shall be air entrained in accordance with Section 1904.2.1.

c. Structural plain concrete basement walls are exempt from the requirements for exposure conditions of Section 1904.2.2 (see Section 1909.6.1).

d. For garage floor slabs where a steel trowel finish is used, the total air content required by Section 1904.2.1 is permitted to be reduced to not less than 3 percent, provided the minimum specified compressive strength of the concrete is increased to 4,000 psi.

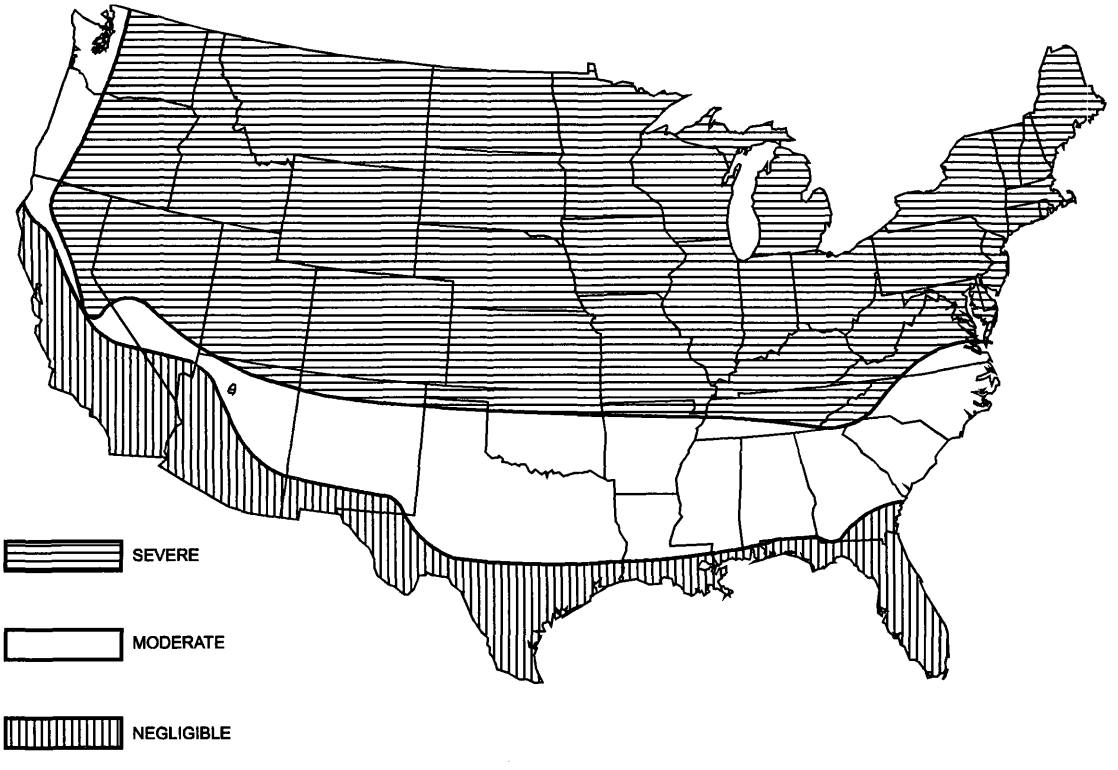


FIGURE 1904.2.2
WEATHERING PROBABILITY MAP FOR CONCRETE[a, b, c]

a. Lines defining areas are approximate only. Local areas can be more or less severe than indicated by the region classification.

b. A "severe" classification is where weather conditions encourage or require the use of deicing chemicals or where there is potential for a continuous presence of moisture during frequent cycles of freezing and thawing. A "moderate" classification is where weather conditions occasionally expose concrete in the presence of moisture to freezing and thawing, but where deicing chemicals are not generally used. A "negligible" classification is where weather conditions rarely expose concrete in the presence of moisture to freezing and thawing.

c. Alaska and Hawaii are classified as severe and negligible, respectively.

1904.3 Sulfate exposures. Concrete that will be exposed to sulfate-containing solutions or soils shall comply with the maximum water-cementitious materials ratios and/or minimum specified compressive strength and be made with the appropriate type of cement in accordance with the provisions of ACI 318, Section 4.3.

1904.4 Corrosion protection of reinforcement. Reinforcement in concrete shall be protected from corrosion and exposure to chlorides in accordance with ACI 318, Section 4.4.

SECTION 1905
CONCRETE QUALITY, MIXING AND PLACING

1905.1 General. The required strength and durability of concrete shall be determined by compliance with the proportioning, testing, mixing and placing provisions of Sections 1905.1.1 through 1905.13.

1905.1.1 Strength. Concrete shall be proportioned to provide an average compressive strength as prescribed in Section 1905.3 and shall satisfy the durability criteria of Section 1904. Concrete shall be produced to minimize the frequency of strengths below f'_c as prescribed in Section 1905.6.3. *For concrete designed and constructed in accordance with this chapter, f'_c shall not be less than 2,500 psi (17.22 MPa).* No maximum specified compressive strength shall apply unless restricted by a specific provision of this code or ACI 318.

1905.2 Selection of concrete proportions. Concrete proportions shall be determined in accordance with the provisions of ACI 318, Section 5.2.

1905.3 Proportioning on the basis of field experience and/or trial mixtures. Concrete proportioning determined on the basis of field experience and/or trial mixtures shall be done in accordance with ACI 318, Section 5.3.

1905.4 Proportioning without field experience or trial mixtures. Concrete proportioning determined without field experience or trial mixtures shall be done in accordance with ACI 318, Section 5.4.

1905.5 Average strength reduction. As data become available during construction, it is permissible to reduce the amount by which the average compressive strength (f'_c) is required to exceed the specified value of f'_c in accordance with ACI 318, Section 5.5.

1905.6 Evaluation and acceptance of concrete. The criteria for evaluation and acceptance of concrete shall be as specified in Sections 1905.6.2 through 1905.6.5.

1905.6.1 Qualified technicians. Concrete shall be tested in accordance with the requirements in Sections 1905.6.2 through 1905.6.5. Qualified field testing technicians shall perform tests on fresh concrete at the job site, prepare specimens required for curing under field conditions, prepare specimens required for testing in the laboratory and record the temperature of the fresh concrete when preparing specimens for strength tests. Qualified laboratory technicians shall perform all required laboratory tests.

1905.6.2 Frequency of testing. The frequency of conducting strength tests of concrete and the minimum number of tests shall be as specified in ACI 318, Section 5.6.2.

Exception: When the total volume of a given class of concrete is less than 50 cubic yards (38 m^3), strength tests are not required when evidence of satisfactory strength is submitted to and approved by the building official.

1905.6.3 Strength test specimens. Specimens prepared for acceptance testing of concrete in accordance with Section 1905.6.2 and strength test acceptance criteria shall comply with the provisions of ACI 318, Section 5.6.3.

1905.6.4 Field-cured specimens. Where required by the building official to determine adequacy of curing and protection of concrete in the structure, specimens shall be prepared, cured, tested and test results evaluated for acceptance in accordance with ACI 318, Section 5.6.4.

1905.6.5 Low-strength test results. Where any strength test (see ACI 318, Section 5.6.2.4) falls below the specified value of f'_c, the provisions of ACI 318, Section 5.6.5, shall apply.

1905.7 Preparation of equipment and place of deposit. Prior to concrete being placed, the space to receive the concrete and the equipment used to deposit it shall comply with ACI 318, Section 5.7.

1905.8 Mixing. Mixing of concrete shall be performed in accordance with ACI 318, Section 5.8.

1905.9 Conveying. The method and equipment for conveying concrete to the place of deposit shall comply with ACI 318, Section 5.9.

1905.10 Depositing. The depositing of concrete shall comply with the provisions of ACI 318, Section 5.10.

1905.11 Curing. The length of time, temperature and moisture conditions for curing of concrete shall be in accordance with ACI 318, Section 5.11.

1905.12 Cold weather requirements. Concrete to be placed during freezing or near-freezing weather shall comply with the requirements of ACI 318, Section 5.12.

1905.13 Hot weather requirements. Concrete to be placed during hot weather shall comply with the requirements of ACI 318, Section 5.13.

SECTION 1906
FORMWORK, EMBEDDED PIPES AND CONSTRUCTION JOINTS

1906.1 Formwork. The design, fabrication and erection of forms shall comply with ACI 318, Section 6.1.

1906.2 Removal of forms, shores and reshores. The removal of forms and shores, including from slabs and beams (except where cast on the ground), and the installation of reshores shall comply with ACI 318, Section 6.2.

1906.3 Conduits and pipes embedded in concrete. Conduits, pipes and sleeves of any material not harmful to concrete and within the limitations of ACI 318, Section 6.3, are permitted to

be embedded in concrete with approval of the registered design professional.

1906.4 Construction joints. Construction joints, including their location, shall comply with the provisions of ACI 318, Section 6.4.

SECTION 1907
DETAILS OF REINFORCEMENT

1907.1 Hooks. Standard hooks on reinforcing bars used in concrete construction shall comply with ACI 318, Section 7.1.

1907.2 Minimum bend diameters. Minimum reinforcement bend diameters utilized in concrete construction shall comply with ACI 318, Section 7.2.

1907.3 Bending. The bending of reinforcement shall comply with ACI 318, Section 7.3.

1907.4 Surface conditions of reinforcement. The surface conditions of reinforcement shall comply with the provisions of ACI 318, Section 7.4.

1907.5 Placing reinforcement. The placement of reinforcement, including tolerances on depth and cover, shall comply with the provisions of ACI 318, Section 7.5. Reinforcement shall be accurately placed and adequately supported before concrete is placed.

1907.6 Spacing limits for reinforcement. The clear distance between reinforcing bars, bundled bars, tendons and ducts shall comply with ACI 318, Section 7.6.

1907.7 Concrete protection for reinforcement. The minimum concrete cover for reinforcement shall comply with Sections 1907.7.1 through 1907.7.7.

1907.7.1 Cast-in-place concrete (nonprestressed). Minimum concrete cover shall be provided for reinforcement in nonprestressed, cast-in-place concrete construction in accordance with ACI 318, Section 7.7.1.

1907.7.2 Cast-in-place concrete (prestressed). The minimum concrete cover for prestressed and nonprestressed reinforcement, ducts and end fittings in cast-in-place prestressed concrete shall comply with ACI 318, Section 7.7.2.

1907.7.3 Precast concrete (manufactured under plant control conditions). The minimum concrete cover for prestressed and nonprestressed reinforcement, ducts and end fittings in precast concrete manufactured under plant control conditions shall comply with ACI 318, Section 7.7.3.

1907.7.4 Bundled bars. The minimum concrete cover for bundled bars shall comply with ACI 318, Section 7.7.4.

1907.7.5 Corrosive environments. In corrosive environments or other severe exposure conditions, prestressed and nonprestressed reinforcement shall be provided with additional protection in accordance with ACI 318, Section 7.7.5.

1907.7.6 Future extensions. Exposed reinforcement, inserts and plates intended for bonding with future extensions shall be protected from corrosion.

1907.7.7 Fire protection. When this code requires a thickness of cover for fire protection greater than the minimum concrete cover specified in Section 1907.7, such greater thickness shall be used.

1907.8 Special reinforcement details for columns. Offset bent longitudinal bars in columns and load transfer in structural steel cores of composite compression members shall comply with the provisions of ACI 318, Section 7.8.

1907.9 Connections. Connections between concrete framing members shall comply with the provisions of ACI 318, Section 7.9.

1907.10 Lateral reinforcement for compression members. Lateral reinforcement for concrete compression members shall comply with the provisions of ACI 318, Section 7.10.

1907.11 Lateral reinforcement for flexural members. Lateral reinforcement for compression reinforcement in concrete flexural members shall comply with the provisions of ACI 318, Section 7.11.

1907.12 Shrinkage and temperature reinforcement. Reinforcement for shrinkage and temperature stresses in concrete members shall comply with the provisions of ACI 318, Section 7.12.

1907.13 Requirements for structural integrity. The detailing of reinforcement and connections between concrete members shall comply with the provisions of ACI 318, Section 7.13, to improve structural integrity.

SECTION 1908
MODIFICATIONS TO ACI 318
RESERVED

SECTION 1909
STRUCTURAL PLAIN CONCRETE

1909.1 Scope. The design and construction of structural plain concrete, both cast-in-place and precast, shall comply with the minimum requirements of Section 1909 and ACI 318, Chapter 22, as modified in Section 1908.

1909.1.1 Special structures. For special structures, such as arches, underground utility structures, gravity walls and shielding walls, the provisions of this section shall govern where applicable.

1909.2 Limitations. The use of structural plain concrete shall be limited to:

1. Members that are continuously supported by soil, such as walls and footings, or by other structural members capable of providing continuous vertical support.
2. Members for which arch action provides compression under all conditions of loading.
3. Walls and pedestals.

The use of structural plain concrete columns and structural plain concrete footings on piles is not permitted. See Section 1908.1.15 for additional limitations on the use of structural plain concrete.

1909.3 Joints. Contraction or isolation joints shall be provided to divide structural plain concrete members into flexurally discontinuous elements in accordance with ACI 318, Section 22.3.

1909.4 Design. Structural plain concrete walls, footings and pedestals shall be designed for adequate strength in accordance with ACI 318, Sections 22.4 through 22.8.

Exception: For Group R-3 occupancies and buildings of other occupancies less than two stories in height of light-frame construction, the required edge thickness of ACI 318 is permitted to be reduced to 6 inches (152 mm), provided that the footing does not extend more than 4 inches (102 mm) on either side of the supported wall.

1909.5 Precast members. The design, fabrication, transportation and erection of precast, structural plain concrete elements shall be in accordance with ACI 318, Section 22.9.

1909.6 Walls. In addition to the requirements of this section, structural plain concrete walls shall comply with the applicable requirements of ACI 318, Chapter 22.

1909.6.1 Basement walls. The thickness of exterior basement walls and foundation walls shall be not less than $7^1/_2$ inches (191 mm). Structural plain concrete exterior basement walls shall be exempt from the requirements for special exposure conditions of Section 1904.2.2.

1909.6.2 Other walls. Except as provided for in Section 1909.6.1, the thickness of bearing walls shall be not less than $^1/_{24}$ the unsupported height or length, whichever is shorter, but not less than $5^1/_2$ inches (140 mm).

1909.6.3 Openings in walls. Not less than two No. 5 bars shall be provided around window and door openings. Such bars shall extend at least 24 inches (610 mm) beyond the corners of openings.

SECTION 1910
MINIMUM SLAB PROVISIONS

1910.1 General. The thickness of concrete floor slabs supported directly on the ground shall not be less than $3^1/_2$ inches (89 mm). A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m^2) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.
4. For driveways, walks, patios and other flatwork which will not be enclosed at a later date.
5. Where approved based on local site conditions.

1910.2 Joints. Concrete slabs on ground shall be provided with joints in accordance with ACI 224.3R or other approved methods. Joints shall be designed by an architect or engineer.

Exception: Joints are not required in unreinforced plain concrete slabs on ground or in slabs for one- and two-family dwellings complying with one of the following:

1. Concrete slabs on ground containing synthetic fiber reinforcement. Fiber lengths and dosage amounts shall comply with one of the following
   1.1 Fiber lengths shall be $^1/_2$ inch to 2 inches (13 to 51 mm) in length. Dosage amounts shall be from 0.75 to 1.5 pounds per cubic yard (0.45 to 0.89 kg/m^3) in accordance with the manufacturer's recommendations. Synthetic fibers shall comply with ASTM C 1116. The manufacturer or supplier shall provide certification of compliance with ASTM C 1116 when requested by the building official; or,
   1.2 Fiber length shall be from $^1/_2$ inch to 2 inches (13 mm to 51 mm) in length, monofilament or fibrillated. Dosage amounts shall be from 0.5 to 1.5 pounds per cubic yard (0.30 to 0.89 kg/m^3) to achieve minimum 40 percent reduction of plastic shrinkage cracking of concrete versus a control mix in accordance with ICBO AC32. Independent test results using minimum six test specimens shall be provided to the building official showing compliance with ICBO A32. Synthetic fiber shall comply with ASTM C 1116, Paragraph 4.1.3, Type III. The manufacturer or supplier shall provide certification of compliance with ASTM C 1116 when requested by building official.
2. Concrete slabs on ground containing 6 × 6 W1.4 × W1.4 welded wire reinforcement fabric located in the middle to the upper one-third of the slab. Welded wire reinforcement fabric shall be supported with approved materials or supports at spacings not to exceed 3 feet (914 mm) or in accordance with the manufacturer's specifications. Welded plain wire reinforcement fabric for concrete shall conform to ASTM A 185, Standard Specification for Steel Welded Wire Reinforcement Fabric, Plain, for Concrete Reinforcement.

SECTION 1911
ANCHORAGE TO CONCRETE—ALLOWABLE STRESS DESIGN

1911.1 Scope. The provisions of this section shall govern the allowable stress design of headed bolts and headed stud anchors cast in normal-weight concrete for purposes of transmitting structural loads from one connected element to the other. These provisions do not apply to anchors installed in hardened concrete. The bearing area of headed anchors shall be not less than one and one-half times the shank area. Where strength design is used, the design strength of anchors shall be determined in accordance with Section 1912. Bolts shall conform to ASTM A 307 or an approved equivalent.

1911.2 Allowable service load. The allowable service load for headed anchors in shear or tension shall be as indicated in Table 1911.2. Where anchors are subject to combined shear and tension, the following relationship shall be satisfied:

$$(P_s / P_t)^{5/3} + (V_s / V_t)^{5/3} \leq 1 \qquad \textbf{(Equation 19-1)}$$

where:

P_s = Applied tension service load, pounds (N).

P_t = Allowable tension service load from Table 1911.2, pounds (N).

V_s = Applied shear service load, pounds (N).

V_t = Allowable shear service load from Table 1911.2, pounds (N).

1911.3 Required edge distance and spacing. The allowable service loads in tension and shear specified in Table 1911.2 are for the edge distance and spacing specified. The edge distance and spacing are permitted to be reduced to 50 percent of the values specified with an equal reduction in allowable service load. Where edge distance and spacing are reduced less than 50 percent, the allowable service load shall be determined by linear interpolation.

1911.4 Increase in allowable load. Increase of the values in Table 1911.2 by one-third is permitted where the provisions of Section 1605.3.2 permit an increase in allowable stress for wind loading.

1911.5 Increase for special inspection. Where special inspection is provided for the installation of anchors, a 100-percent increase in the allowable tension values of Table 1911.2 is permitted. No increase in shear value is permitted.

SECTION 1912
ANCHORAGE TO CONCRETE—STRENGTH DESIGN

1912.1 Scope. The provisions of this section shall govern the strength design of anchors installed in concrete for purposes of transmitting structural loads from one connected element to the other. Headed bolts, headed studs and hooked (J- or L-) bolts cast in concrete and expansion anchors and undercut anchors installed in hardened concrete shall be designed in accordance with Appendix D of ACI 318 as modified by Section 1908.1.16, provided they are within the scope of Appendix D.

Exception: Where the basic concrete breakout strength in tension of a single anchor, N_b, is determined in accordance with Equation (D-7), the concrete breakout strength requirements of Section D.4.2.2 shall be considered satisfied by the design procedures of Sections D.5.2 and D.6.2 for anchors exceeding 2 inches (51 mm) in diameter or 25 inches (635 mm) tensile embedment depth.

The strength design of anchors that are not within the scope of Appendix D of ACI 318, and as amended above, shall be in accordance with an approved procedure.

SECTION 1913
SHOTCRETE

1913.1 General. Shotcrete is mortar or concrete that is pneumatically projected at high velocity onto a surface. Except as specified in this section, shotcrete shall conform to the requirements of this chapter for plain or reinforced concrete.

1913.2 Proportions and materials. Shotcrete proportions shall be selected that allow suitable placement procedures using the delivery equipment selected and shall result in fin-

TABLE 1911.2
ALLOWABLE SERVICE LOAD ON EMBEDDED BOLTS (pounds)

BOLT DIAMETER (inches)	MINIMUM EMBEDMENT (inches)	EDGE DISTANCE (inches)	SPACING (inches)	MINIMUM CONCRETE STRENGTH (psi)					
				f'_c = 2,500		f'_c = 3,000		f'_c = 4,000	
				Tension	Shear	Tension	Shear	Tension	Shear
1/4	2 1/2	1 1/2	3	200	500	200	500	200	500
3/8	3	2 1/4	4 1/2	500	1,100	500	1,100	500	1,100
1/2	4	3	6	950	1,250	950	1,250	950	1,250
	4	5	5	1,450	1,600	1,500	1,650	1,550	1,750
5/8	4 1/2	3 3/4	7 1/2	1,500	2,750	1,500	2,750	1,500	2,750
	4 1/2	6 1/4	7 1/2	2,125	2,950	2,200	3,000	2,400	3,050
3/4	5	4 1/2	9	2,250	3,250	2,250	3,560	2,250	3,560
	5	7 1/2	9	2,825	4,275	2,950	4,300	3,200	4,400
7/8	6	5 1/4	10 1/2	2,550	3,700	2,550	4,050	2,550	4,050
1	7	6	12	3,050	4,125	3,250	4,500	3,650	5,300
1 1/8	8	6 3/4	13 1/2	3,400	4,750	3,400	4,750	3,400	4,750
1 1/4	9	7 1/2	15	4,000	5,800	4,000	5,800	4,000	5,800

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound = 4.45 N.

ished in-place hardened shotcrete meeting the strength requirements of this code.

1913.3 Aggregate. Coarse aggregate, if used, shall not exceed $^3/_4$ inch (19.1 mm).

1913.4 Reinforcement. Reinforcement used in shotcrete construction shall comply with the provisions of Sections 1913.4.1 through 1913.4.4.

1913.4.1 Size. The maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction tests that adequate encasement of larger bars will be achieved.

1913.4.2 Clearance. When No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of $2^1/_2$ inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars used. When two curtains of steel are provided, the curtain nearer the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.

Exception: Subject to the approval of the building official, required clearances shall be reduced where it is demonstrated by preconstruction tests that adequate encasement of the bars used in the design will be achieved.

1913.4.3 Splices. Lap splices of reinforcing bars shall utilize the noncontact lap splice method with a minimum clearance of 2 inches (51 mm) between bars. The use of contact lap splices necessary for support of the reinforcing is permitted when approved by the building official, based on satisfactory preconstruction tests that show that adequate encasement of the bars will be achieved, and provided that the splice is oriented so that a plane through the center of the spliced bars is perpendicular to the surface of the shotcrete.

1913.4.4 Spirally tied columns. Shotcrete shall not be applied to spirally tied columns.

1913.5 Preconstruction tests. When required by the building official, a test panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The sample panel shall be representative of the project and simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official.

1913.6 Rebound. Any rebound or accumulated loose aggregate shall be removed from the surfaces to be covered prior to placing the initial or any succeeding layers of shotcrete. Rebound shall not be used as aggregate.

1913.7 Joints. Except where permitted herein, unfinished work shall not be allowed to stand for more than 30 minutes unless edges are sloped to a thin edge. For structural elements that will be under compression and for construction joints shown on the approved construction documents, square joints are permitted. Before placing additional material adjacent to previously applied work, sloping and square edges shall be cleaned and wetted.

1913.8 Damage. In-place shotcrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced while still plastic.

1913.9 Curing. During the curing periods specified herein, shotcrete shall be maintained above 40°F (4°C) and in moist condition.

1913.9.1 Initial curing. Shotcrete shall be kept continuously moist for 24 hours after shotcreting is complete or shall be sealed with an approved curing compound.

1913.9.2 Final curing. Final curing shall continue for seven days after shotcreting, or for three days if high-early-strength cement is used, or until the specified strength is obtained. Final curing shall consist of the initial curing process or the shotcrete shall be covered with an approved moisture-retaining cover.

1913.9.3 Natural curing. Natural curing shall not be used in lieu of that specified in this section unless the relative humidity remains at or above 85 percent, and is authorized by the registered design professional and approved by the building official.

1913.10 Strength tests. Strength tests for shotcrete shall be made by an approved agency on specimens that are representative of the work and which have been water soaked for at least 24 hours prior to testing. When the maximum-size aggregate is larger than $^3/_8$ inch (9.5 mm), specimens shall consist of not less than three 3-inch-diameter (76 mm) cores or 3-inch (76 mm) cubes. When the maximum-size aggregate is $^3/_8$ inch (9.5 mm) or smaller, specimens shall consist of not less than 2-inch-diameter (51 mm) cores or 2-inch (51 mm) cubes.

1913.10.1 Sampling. Specimens shall be taken from the in-place work or from test panels, and shall be taken at least once each shift, but not less than one for each 50 cubic yards (38.2 m^3) of shotcrete.

1913.10.2 Panel criteria. When the maximum-size aggregate is larger than $^3/_8$ inch (9.5 mm), the test panels shall have minimum dimensions of 18 inches by 18 inches (457 mm by 457 mm). When the maximum size aggregate is $^3/_8$ inch (9.5 mm) or smaller, the test panels shall have minimum dimensions of 12 inches by 12 inches (305 mm by 305 mm). Panels shall be shot in the same position as the work, during the course of the work and by the nozzlemen doing the work. The conditions under which the panels are cured shall be the same as the work.

1913.10.3 Acceptance criteria. The average compressive strength of three cores from the in-place work or a single test panel shall equal or exceed $0.85f'_c$ with no single core less than $0.75f'_c$. The average compressive strength of three cubes taken from the in-place work or a single test panel shall equal or exceed f'_c with no individual cube less than $0.88f'_c$. To check accuracy, locations represented by erratic core or cube strengths shall be retested.

SECTION 1914
REINFORCED GYPSUM CONCRETE

1914.1 General. Reinforced gypsum concrete shall comply with the requirements of ASTM C 317 and ASTM C 956.

1914.2 Minimum thickness. The minimum thickness of reinforced gypsum concrete shall be 2 inches (51 mm) except the minimum required thickness shall be reduced to $1^1/_2$ inches (38 mm), provided the following conditions are satisfied:

1. The overall thickness, including the formboard, is not less than 2 inches (51 mm).
2. The clear span of the gypsum concrete between supports does not exceed 33 inches (838 mm).
3. Diaphragm action is not required.
4. The design live load does not exceed 40 pounds per square foot (psf) (1915 Pa).

SECTION 1915
CONCRETE-FILLED PIPE COLUMNS

1915.1 General. Concrete-filled pipe columns shall be manufactured from standard, extra-strong or double-extra-strong steel pipe or tubing that is filled with concrete so placed and manipulated as to secure maximum density and to ensure complete filling of the pipe without voids.

1915.2 Design. The safe supporting capacity of concrete-filled pipe columns shall be computed in accordance with the approved rules or as determined by a test.

1915.3 Connections. Caps, base plates and connections shall be of approved types and shall be positively attached to the shell and anchored to the concrete core. Welding of brackets without mechanical anchorage shall be prohibited. Where the pipe is slotted to accommodate webs of brackets or other connections, the integrity of the shell shall be restored by welding to ensure hooping action of the composite section.

1915.4 Reinforcement. To increase the safe load-supporting capacity of concrete-filled pipe columns, the steel reinforcement shall be in the form of rods, structural shapes or pipe embedded in the concrete core with sufficient clearance to ensure the composite action of the section, but not nearer than 1 inch (25 mm) to the exterior steel shell. Structural shapes used as reinforcement shall be milled to ensure bearing on cap and base plates.

1915.5 Fire-resistance-rating protection. Pipe columns shall be of such size or so protected as to develop the required fire-resistance ratings specified in Table 601. Where an outer steel shell is used to enclose the fire protective covering, the shell shall not be included in the calculations for strength of the column section. The minimum diameter of pipe columns shall be 4 inches (102 mm) except that in structures of Type V construction not exceeding three stories or 40 feet (12 192 mm) in height, pipe columns used in the basement and as secondary steel members shall have a minimum diameter of 3 inches (76 mm).

1915.6 Approvals. Details of column connections and splices shall be shop fabricated by approved methods and shall be approved only after tests in accordance with the approved rules. Shop-fabricated concrete-filled pipe columns shall be inspected by the building official or by an approved representative of the manufacturer at the plant.

SECTION 1916
RESERVED

SECTION 1917
LIGHTWEIGHT INSULATING CONCRETE ROOF DECK

1917.1 Lightweight insulating concrete. Material produced with or without aggregate additions to portland cement, water and air to form a hardened material possessing insulating qualities, which, when oven dried shall have a unit weight no greater than 50 pcf (801 kg/m^3).

1917.1.1 Aggregate lightweight insulating concrete. Insulating concrete formulated predominantly with perlite or vermiculite aggregate having a minimum compressive strength of 125 psi (861.8 kPa) when tested in compliance with ASTM C 495.

1917.1.2 Cellular lightweight insulating concrete. Insulating concrete formulated by mixing a hydrated cementitious matrix around noninterconnecting air cells created by the addition of preformed foam formed from hydrolyzed proteins or synthetic surfactants. The cured cellular lightweight insulating concrete shall have minimum compressive strength of 160 psi (1103 kPa) when tested in compliance with ASTM C 495 and C 796.

1917.1.3 Cellular/aggregate (hybrid) lightweight insulating concrete. Insulated concrete formulated by combining preformed foam with low density aggregates to impart properties of both aggregate and cellular lightweight insulating concrete. It shall have a minimum compressive strength of 200 psi (1379 kPa) when tested in compliance with ASTM C 495 and C 796.

1917.1.4 Walkability. A term defining the ability of lightweight insulating concrete to withstand anticipated construction foot traffic during the roof membrane application without significant indentations in the lightweight insulating concrete surface.

1917.2 Inspection.

1917.2.1 Application of all lightweight insulating concrete roof decks shall be by applicators approved by the lightweight insulating concrete deck manufacturer. Product Approval shall be required for all lightweight insulating concrete systems.

1917.2.2 The permit holder shall notify the building official 48 hours prior to the pouring of lightweight insulating concrete.

1917.2.3 The permit holder shall make available to the building official a job log with the following minimum items.

1. Cast density recordings/hour.
2. Product evaluation for application.

3.Date and job locations identified.

4.Results of any field test conducted.

1917.2.4 Once the roof deck system can support foot traffic, the building official shall have clear access and clear path at his option for inspection of lightweight insulating concrete.

1917.3 Testing. The building official may require tests of the lightweight insulating concrete to confirm the fastener withdrawal resistance, compressive strength or drainage ability.

1917.3.1 Existing roof assemblies to receive lightweight insulating concrete other than galvanized G-90 steel deck or structural concrete deck shall be tested for uplift for adhesion to the substrate to confirm compliance with design pressure.

1917.4 Materials and limitations of use. Lightweight insulating concrete, in conjunction with galvanized formed steel sheets, shall not be used as a roof deck in areas where highly corrosive chemicals are used or stored.

1917.4.1 Lightweight insulating concrete shall be poured over bottom slotted galvanized (G-90) steel decking as follows; cellular, 0.5 percent open; hybrid, 0.75 percent open, aggregate 1.5 percent open. No lightweight insulating concrete shall be poured over a painted or non-galvanized steel deck.

1. Lightweight insulating concrete over structural concrete slabs, twin tees, precast units or other non venting substrates shall be vented to allow the escape of excess moisture.

1917.4.2 Minimum thickness of lightweight insulating concrete shall be 2 inches (51 mm) over the top plane of the substrate unless otherwise specified in the Product Approval. Lightweight insulating concrete shall be of sufficient thickness to receive the specified base ply fastener length.

1917.4.3 Reserved.

1917.4.4 Galvanized coatings of formed steel sheets shall be in accordance with ASTM A 525 with a minimum coating designation of G-90. Base steel shall conform to ASTM A 446, Grade A, B, C, D or greater and ASTM A 611 C, D or E.

1917.4.5 Chemical admixtures shall be in compliance with ASTM C 494. Calcium chloride or any admixture containing chloride salts shall not be used in insulating concrete. Fiber reinforcement may be used to control cracking. Mineral admixtures shall conform to ASTM C618.

1917.4.6 Vermiculite or perlite shall be in compliance with ASTM C332, Group I. Foam concentrates shall be in compliance with ASTM C796 and ASTM C869.

1917.4.7 Mixing, placing and finishing shall be in compliance with the deck system Product Approval. Slurry coating, two-density casting and double casting shall be acceptable per the specific manufacturer's recommendations.

1917.4.8 If the lightweight insulating concrete deck is to receive Product Approval for a direct-adhered roofing system, the deck surface shall be prepared to the requirements set forth in the roof system Product Approval.

1917.4.9 All base ply fasteners for use in lightweight insulating concrete roof decks shall have a Product Approval for use with the specific lightweight insulating concrete roof system in compliance with manufacturer's recommendations and the design pressure of Section 1609.

1917.4.10 The lightweight insulating concrete fastener withdrawal shall have a minimum resistance for new pours of

1. 60 pounds (267 N) in 28 days when the fastener is installed and allowed to age in the concrete.
2. 40 pounds (178 N) at time of roofing.

1917.4.11 Lightweight insulating concrete system expansion joints shall be provided at the following locations:

1. Where expansion joints are provided in the structural assembly.
2. Where steel framing, structural steel or decking change direction
3. Where separate wings of "L," "U," "T" or similar configurations exist
4. Where the type of decking changes (for example, where a precast concrete deck and a steel deck abut)
5. Whenever additions are connected to existing buildings.
6. At junctions where interior heating conditions change
7. Wherever differential movement between vertical walls and the roof deck may occur.

1917.4.12 Insulation board with lightweight insulating concrete shall conform to Type I expanded polystyrene insulation as defined in ASTM C578.

1. Packaged insulation board delivered to the job site shall comply with the provisions of Section 2603.2 or Section 2612.1.3.
2. Installation of insulating board in conjunction with lightweight insulating concrete shall comply with uplift requirements set forth in Section 1609. Insulation panels shall be placed in a minimum $^1/_8$-inch (3.2 mm) slurry bed of insulating concrete while the material is still in a plastic state. The insulating concrete shall be cast over the insulation boards according to the insulating concrete manufacturer's Product Approval. Insulation panels shall be provided with holes and/or slots for keying and venting.

1917.4.13 Reinforcing mesh shall be provided as required to meet fire-rating and/or special structural design requirements. Refer to a specific Product Approval for the specific requirements applicable to the product being installed.

SECTION 1918
SPECIAL WIND PROVISIONS FOR CONCRETE

1918.1 Reinforced concrete components. The design and construction of reinforced concrete components for buildings sited in areas with a basic wind speed greater than 100 mph (45 m/s) in accordance with Figure 1609 shall conform to the

requirements of ACI 318 or with Section 1609.1.1, Exception 3, as applicable, except as modified in this section.

1918.2 Insulated concrete form wall. Insulated concrete form (ICF) wall construction for buildings shall be in accordance with ACI 318 or with Section 1609.1.1, Exception 3, as applicable.

1918.3 Gable endwalls.

1918.3.1 General. Gable endwalls shall be structurally continuous between points of lateral support.

1918.3.2 Cathedral endwalls. Gable endwalls adjacent to cathedral ceilings shall be structurally continuous from the uppermost floor to ceiling diaphragm or to the roof diaphragm.

SECTION 1919
HIGH-VELOCITY HURRICANE ZONES—GENERAL

1919.1 Scope. This section prescribes requirements for reinforced concrete in construction regulated by this code.

1919.2 Application. Reinforced concrete shall be of the materials, proportions strength and consistency as set forth in this section and shall be designed by methods admitting of rational analysis according to established principles of mechanics.

1919.3 Requirements. All structures of reinforced concrete, including prestressed concrete, shall be designed and constructed in accordance with the provisions of ACI 318 as adopted herein.

1919.4 Workmanship. Concrete construction shall be in conformance with the tolerance, quality and methods of construction set forth in Section1920.

SECTION 1920
HIGH-VELOCITY HURRICANE ZONES — STANDARDS

1920.1 The following standards are hereby adopted as part of this code as set forth in Chapter 35 of this code.

1920.2 American Concrete Institute (ACI).

1. Standard Tolerances for Concrete Construction and Materials, ACI 117.
2. Specifications for Structural Concrete for Buildings, ACI 301.
3. Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315.
4. Building Code Requirements for Reinforced Concrete, ACI 318.
5. Recommended Practice for Concrete Formwork, ACI 347.
6. Recommended Practice for Shotcreting, ACI 506.
7. Specification for Materials, Proportioning, and Application of Shotcrete, ACI 506.2.
8. Deformed and Plain Billet Steel Bars for Concrete Reinforcement, ASTM A615, including S1.

1920.3 American National Standards Institute (ANSI)/American Society of Civil Engineers (ASCE).

1. Specifications for the Design and Construction of Composite Slabs and Commentary on Specifications for the Design and Construction of Composite Slabs, ANSI/ASCE 3.
2. Guideline for Structural Assessment of Existing Buildings, ANSI/ASCE 11.

1920.4 American Society for Testing Materials (ASTM).

1. Deformed and Plain Billet Steel Bars for Concrete Reinforcement, ASTM A 615, including S1.
2. Testing Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation, ASTM C 1077.

SECTION 1921
HIGH-VELOCITY HURRICANE ZONES—DEFINITIONS

1921.1 The following definitions apply to the provisions of Sections 1919 through 1929.

PLAIN CONCRETE. Concrete that is either unreinforced or contains less reinforcement than the minimum amount specified for reinforced concrete.

REINFORCED CONCRETE. Concrete reinforced with no less than the minimum amount required by ACI 318, prestressed or non-prestressed, and designed on the assumption that the two materials act together in resisting forces.

PRESTRESSED CONCRETE. Reinforced concrete in which internal stresses have been introduced to reduce potential tensile stresses in concrete resulting from loads, The term prestressed concrete refers to pretensioned concrete in which the reinforcing is tensioned before hardening of the concrete, to postensioned concrete in which the reinforcing is tensioned after hardening of the concrete, or combinations of both pretensioning and posttensioning.

PRECAST CONCRETE. Plain or reinforced concrete elements cast elsewhere than their final position in a structure.

SHOTCRETE. Mortar or concrete pneumatically projected at high velocity onto a surface.

SECTION 1922
HIGH-VELOCITY HURRICANE ZONES—MATERIALS

1922.1 Cements. Cements shall conform to one of the following specifications for portland cement as set forth in Chapter 35.

1. Portland Cement, ASTM C 150.
2. Blended Hydraulic Cements, ASTM C 595, excluding Types S and SA, which are not intended as principal cementing constituents of structural concrete.

1922.2 Aggregates for concrete shall conform to one of the following specifications as set forth in Chapter 35 of this code or Section 1922.2.1.

1. Concrete Aggregates, ASTM C 33.

2. Lightweight Aggregates for Structural Concrete, ASTM C 330.

1922.2.1 Gradation of locally produced sand and crushed rock aggregate shall be as follows:

COARSE AGGREGATE

Percent Passing		
$1^1/_2$ inches	sieve	100
1 inches	sieve	95 - 100
1/2 inches	sieve	25 - 60
#4	sieve	0 - 10
#8	sieve	0 - 5

FINE AGGREGATE

Percent Passing		
3/8 inches	sieve	100
#4	sieve	90 - 100
#8	sieve	70 - 95
#16	sieve	50 - 85
#30	sieve	30 - 70
#50	sieve	10 - 45
#100	sieve	0 - 10

1922.2.2 Aggregates failing to meet ASTM C 33, ASTM C 330 or the above special gradation but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when certified by the engineer.

1922.2.3 Aggregates shall be quarried or washed in fresh water and shall contain not more than 1/20 of 1-percent salt by weight.

1922.3 Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to concrete or reinforcement.

1922.3.1 Mixing water for concrete, including that portion of mixing water contributed in the form of free moisture on aggregates, shall not contain deleterious amounts of chloride ion.

1922.4 Reinforcement.

1922.4.1 Deformed reinforcement shall conform to one of the specifications as set forth in Chapter 35, except as provided in Section 3.5 of ACI 318.

1922.4.2 Prestressing tendons shall conform to one of the specifications as set forth in Chapter 35.

Exception: Wire strands and bars not specifically listed in ASTM A 421, A 416, or A 722 may be used provided they conform to minimum requirements of these specifications and do not have properties that make them less satisfactory than those listed in ASTM A 416, A 421 or A 722.

1922.4.3 Reinforcement consisting of structural steel, steel pipe or steel tubing may be used as specified in ACI 318.

1922.4.4 All welding of reinforcement shall conform to the Structural Welding Code - Reinforcing Steel, AWS D1.4, as set forth in Chapter 35.

1922.4.5 Reinforcement to be welded shall be indicated on the drawings, and welding procedures to be used shall be specified. ASTM steel specifications, except ASTM A 706, shall be supplemented to require a report of material properties necessary to conform to welding procedures specified in AWS D1.4.

1922.4.6 Deformed reinforcement may be galvanized or epoxy-coated in accordance with the Specifications for Zinc-Coated (galvanized) Bars for Concrete reinforcement, ASTM A 767 or the Specification for Epoxy-Coated Bars, ASTM A 775. Zinc or epoxy-coated reinforcement shall conform to ASTM A 615, A 616 (S1), A 617 or A 706.

1922.5 Admixtures.

1922.5.1 Admixtures to be used in concrete shall conform to one of the specifications set forth in Chapter 35.

1922.5.2 An admixture shall be shown capable of maintaining essentially the same composition and performance throughout the work as the product used in establishing concrete proportions.

1922.5.3 Admixtures containing chloride ions shall not be used in concrete if their use will produce a deleterious concentration of chloride ion in the mixing water.

1922.6 Test of materials.

1922.6.1 The building official, or his or her authorized representative, shall have the right to order the test of any material entering into concrete or reinforced concrete to determine its suitability for the purpose; to order reasonable tests of the concrete from time to time to determine whether the materials and methods in use are such as to produce concrete of the necessary quality; and to order the test under load of any portion of a completed structure when conditions have been such as to leave doubt as to the adequacy of the structure to serve the purpose for which it is intended.

1922.6.2 Materials and of concrete shall be tested in accordance with applicable standards of ASTM International as listed in Chapter 35. Tests shall be made by an approved testing laboratory and results of such tests shall be submitted to the building official. Approved testing laboratories shall comply with ASTM C 1077.

1922.6.3 A complete record of tests of materials and of concrete shall be available to the building official for inspection during progress of work and for five years after completion of the project, and shall be preserved by the inspecting engineer or architect for that purpose.

1922.6.4 If doubt develops concerning the safety of a structure or member, the building official may order a structural strength investigation by analysis or by means of load tests, or by a combination of analyses and load test as set forth in Chapter 20 of ACI 318.

SECTION 1923
HIGH-VELOCITY HURRICANE ZONES—CONCRETE QUALITY

1923.1 General.

1923.1.1 Concrete shall be proportioned and produced to provide an average compressive strength sufficiently high to minimize the frequency of strength test below the specified compressive strength of concrete, $f'c$.

1923.1.2 Requirements for $f'c$ shall be based on tests of cylinders made and tested as prescribed in Section 1923.2.2.3.

1923.1.3 Unless otherwise specified, $f'c$ shall be based on 28-day tests. If other than 28-day tests are called for, $f'c$ shall be indicated in design drawings or specifications.

1923.1.4 Design drawings shall show the specified compressive strength of concrete, $f'c$ for which each part of the structure is designed.

1923.2 Evaluation and acceptance concrete.

1923.2.1 Frequency of testing.

1923.2.1.1 The building official may require a reasonable number of tests to be made during the progress of the work, or may promulgate and set forth in writing such reasonable rules for requiring tests to be made by an approved laboratory as he may consider necessary to insure compliance with this code.

1923.2.1.2 Not less than three specimens shall be made for each standard test.

1923.2.1.3 Samples for strength of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cubic yard (4.3 m^3) of concrete, nor less than once for each 5,000 square feet (465 m^2) of surface area for slabs or walls.

1923.2.1.4 On a given project, if total volume of concrete is such that frequency of testing required by Section 1923.2.1.1 would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

1923.2.1.5 Test cylinders taken on truck-mixed concrete shall be taken at the approximate one-quarter point of the load.

1923.2.1.6 The age for strength tests shall be 28 days, or where specified, at the earlier age at which the concrete is to receive its full working load.

1923.2.2 Laboratory cured specimens.

1923.2.2.1 A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at a test age designated for determination of $f'c$.

1923.2.2.2 Samples of strength tests shall be taken in accordance with the Method of Sampling Fresh Concrete, ASTM C 172, as set forth in Chapter 35.

1923.2.2.3 Cylinders for strength tests shall be molded and laboratory-cured in accordance with the Method of Making and Curing Concrete Test Specimens in the Field, ASTM C 31, as set forth in Chapter 35 of this code, and tested in accordance with the Method of Test for Compressive Strength of Cylindrical Concrete Specimens, ASTM C 39, as set forth in Chapter 35.

1923.2.2.4 The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:

1. Average of all sets of three consecutive strength tests equal or exceed $f'c$.
2. No individual strength test (average of 2 cylinders) falls below $f'c$ by more than 500 psi (3448 kPa).

1923.2.2.5 If any of the requirements of Section 1923.2 are not met, steps shall be taken to increase the average of subsequent strength test results. Requirements of Section 1923.2.4 shall be observed if any individual strength test falls below $f'c$ by more than 500 psi (3448 kPa).

1923.2.3 Field cured specimens.

1923.2.3.1 The building official may require strength tests of cylinders cured under field conditions to check adequacy of curing and protection of concrete in the structure.

1923.2.3.2 Field-cured cylinders shall be cured under field conditions in accordance with Section 7.4 of the Method of Making and Curing Concrete Test specimens in the Field, ASTM C 31.

1923.2.3.3 Field-cured test cylinders shall be molded at the same time and from the same samples as laboratory-cured test cylinders.

1923.2.3.4 Procedures for protecting and curing concrete shall be improved when the strength of field-cured cylinders at test age designated for determination of $f'c$ is less than 85 percent of that of companion laboratory cured cylinders. The 85 percent may be waived if field cured strength exceeds $f'c$ by more than 500 psi (3448 Pa).

1923.2.4 Investigation of low strength test results.

1923.2.4.1 When there is a question as to the quality of the concrete in the structure, the building official may require core tests in accordance with the Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, ASTM C 42, as set forth in Chapter 35 of this code, or order load tests on that portion of the structure where the questionable concrete has been placed.

1923.2.4.2 When concrete in structures has failed to meet the minimum standard, the building official shall order analysis and reports by a registered engineer to determine the adequacy of the structure.

1923.2.4.3 If the likelihood of low-strength concrete is confirmed and computations indicate that load-carrying capacity may have been significantly reduced, tests of cores drilled from the area in question may be required in accordance with the Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, ASTM C 42, as set forth in Chapter 35 of this code. In such case,

three cores shall be taken for each strength test more than 500 psi (3448 kPa) below specified value of $f'c$.

1923.2.4.4 If concrete in the structure will be dry under service conditions, cores shall be air dried at a temperature between 60°F (15°C) and 80°F (27°) and a relative humidity less than 60 percent for 7 days before testing and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 40 hours and be tested wet.

1923.2.4.5 Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equals to at least 85 percent of f¢c and if no single core is less than 75 percent of $f'c$. To check testing accuracy, locations represented by erratic core strengths may be retested.

1923.2.4.6 Slump considerations. The maximum allowable slump of concrete shall be 6 inches (152 mm). On jobs controlled and supervised by a professional engineer, this maximum may be exceeded, but no concrete shall exceed the slump as indicated on the approved plans for proposed work.

SECTION 1924
HIGH-VELOCITY HURRICANE ZONES—MIXING AND PLACING CONCRETE

1924.1 Preparation of equipment and place of deposit.

1924.1.1 Preparation before concrete placement shall include the following:

1. All equipment for mixing and transporting concrete shall be clean.
2. All debris shall be removed from the spaces to be occupied by the concrete.
3. Forms shall be properly coated.
4. Masonry filler units that will be in contact with concrete shall be well drenched.
5. Reinforcement shall be thoroughly cleaned of deleterious coatings.
6. Water shall be removed from place of deposit before concrete is placed unless a tremie is to be used or unless otherwise permitted by the professional engineer.
7. All laitance and other unsound material shall be removed before additional concrete is placed against hardened concrete.

1924.2 Mixing.

1924.2.1 All concrete shall be mixed until there is uniform distribution of materials and shall be discharged completely before the mixer is recharged.

1924.2.2 Ready-mixed concrete shall be mixed and delivered in accordance with requirements of the Specifications for Ready-Mixed Concrete, ASTM C 94, or the Specifications for Concrete Made by Volumetric Batching and Continuous Mixing, ASTM C 685, as set forth in Chapter 35 of this code.

1924.2.3 Job-mixed concrete shall be mixed in accordance with the following:

1. Mixing shall be done in a batch mixer of approved type.
2. Mixer shall be rotated at a speed recommended by the manufacturer.
3. Mixing shall be continued for at least 11/2 minutes after all materials are in the drum, unless a shorter time is shown to be satisfactory by the mixing uniformity test of Specification for Ready-Mixed Concrete, ASTM C 94.
4. Materials handling, batching, and mixing shall conform to applicable provisions of the Specifications for Ready-Mixed Concrete, ASTM C 94.
5. A detailed record shall be kept to identify:
   - 5.1. Number of batches produced.
   - 5.2. Proportions of materials used.
   - 5.3. Approximate location of final deposit in structure.
   - 5.4. Time and date of mixing and placing.

1924.3 Conveying.

1924.3.1 Concrete shall be conveyed from mixer to the place of final deposit by methods that will prevent separation or loss of the materials.

1924.3.2 Conveying equipment shall be capable of providing a supply of concrete at the site of placement without separation of ingredients and without interruptions sufficient to permit loss of plasticity between successive increments.

1924.4 Depositing.

1924.4.1 Concrete shall be deposited as nearly as practicable in its final position to avoid segregation caused by rehandling or flowing.

1924.4.2 Concreting shall be carried on at such a rate that concrete is at all times plastic and flows readily into the spaces between reinforcement.

1924.4.3 Concrete that has partially hardened or been contaminated by foreign materials shall not be deposited in the structure.

1924.4.4 Retempered concrete or concrete that has been remixed after initial set shall not be used unless approved by the building official.

1924.4.5 After concreting is started, it shall be carried on as a continuous operation until placing of the panel or section, as defined by its boundaries or predetermined joints is completed except as permitted or prohibited by Section 1925.4.

1924.4.6 Top surfaces of vertically formed lifts shall be generally level.

1924.4.7 When construction joints are required, joints shall be made in accordance with Section 1925.4.

1924.4.8 All concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around the reinforcement and embedded fixtures and into corners of forms.

1924.5 Curing.

1924.5.1 Concrete, other than high-early-strength, shall be maintained in a moist condition for as least the first seven days after placement, except when cured in accordance with Section 1924.5.3.

1924.5.2 High-early-strength concrete shall be maintained in a moist condition for at least the first three days, except when cured in accordance with Section 1924.5.3.

1924.5.3 Accelerated curing.

1. Curing by high-pressure steam, steam at atmospheric pressure, heat and moisture, or other accepted processes, may be employed to accelerate strength gain and reduce time of curing.
2. Accelerated curing shall provide a compressive strength of the concrete at the load stage considered at least equal to required design strength at that load stage.
3. The curing process shall produce concrete with a durability at least equivalent to the curing method of Section 1924.5.3, Items 1 or 2.
4. Supplementary strength tests in accordance with Section 1923.2.3 may be required to ensure that curing is satisfactory.

1924.6 Bonding.

1924.6.1 Before fresh concrete is deposited or placed on or against concrete which has hardened for 8 hours or longer, the forms shall be retightened, the surface of the hardened concrete shall be cleaned of all foreign matter and laitance, and dampened, but not saturated. Fresh concrete shall not be deposited or placed on or against hardened concrete so dampened before the surface is completely free of shiny spots indicating free moisture. When the concrete against which fresh concrete will be placed is less than 8 hours old, all laitance, loose particles and dirt shall be removed.

1924.6.2 Where bonding of fresh to hardened concrete is necessary, construction joints and joints between footings and walls or columns, between walls or columns and beams or floors they support, and joints in unexposed walls shall be accomplished by reinforcement, dowels, adhesives, mechanical connectors or other approved methods. Hardened concrete at joints shall be dampened, but not saturated, immediately prior to the placement of fresh concrete.

SECTION 1925
HIGH-VELOCITY HURRICANE ZONES—FORMWORK, EMBEDDED PIPES AND CONSTRUCTION JOINTS

1925.1 Design of formwork.

1925.1.1 Forms shall be designed in accordance with ACI 347, Recommended Practice for Concrete Formwork.

1925.1.2 Forms shall result in a final structure that conforms to shapes, lines and dimensions of the members as required by the design drawings and specifications.

1925.1.3 Forms shall be substantial and sufficiently tight to prevent leakage of mortar.

1925.1.4 Forms shall be properly braced or tied together to maintain position and shape.

1925.1.5 Forms and their supports shall be designed so as not to damage previously placed structures.

1925.1.6 Design of formwork shall include consideration of the rate and method of placing concrete; construction loads, including vertical, horizontal and impact loads; and special form requirements for construction of shells, folded plates, domes, architectural concrete or similar types of elements.

1925.1.7 Forms for prestressed concrete members shall be designed and constructed to permit movement of the member without damage during application of prestressing force.

1925.2 Removal of forms and shores.

1925.2.1 No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with the remaining forming and shoring system has sufficient strength to safely support its weight and loads placed thereon.

1925.2.2 Sufficient strength shall be demonstrated by structural analysis considering proposed loads, strength of the forming and shoring system and concrete strength data. Concrete strength data may be based on tests of field-cured cylinders or, when approved by the building official, on other procedures to evaluate concrete strength. Structural analysis and concrete strength test data shall be furnished to the building official when so required.

1925.2.3 No construction loads exceeding the combination of superimposed dead load plus specified live load shall be supported on any unshored portion of the structure under construction, unless analysis indicated adequate strength to support such additional loads.

1925.2.4 Forms shall be removed in a manner that does not impair the safety and serviceability of the structure. All concrete to be exposed by form removal shall have sufficient strength not to be damaged thereby.

1925.2.5 Form supports for prestressed concrete members may be removed when sufficient prestressing has been applied to enable prestressed members to carry their dead load and anticipated construction loads.

1925.3 Conduits and pipes embedded in concrete.

1925.3.1 Conduits, pipes and sleeves of any material not harmful to concrete, and with limitations of this section, may be embedded in concrete with approval of the professional engineer provided they are not considered to structurally replace the displaced concrete.

1925.3.2 Conduits or pipes of aluminum shall not be embedded in structural concrete unless effectively coated or

covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

1925.3.3 Conduits, pipes and sleeves passing through a slab, wall or beam shall not impair the strength of the construction.

1925.3.4 Conduits and pipes, with their fittings, embedded within a column shall not displace more than 4 percent of the area of cross section on which strength is calculated or which is required for fire protection.

1925.3.5 Except when plans for conduits and pipes are approved by the professional engineer and other than those merely passing through, conduits and pipes embedded within a slab, wall or beam shall satisfy the following:

1. They shall not be larger in outside dimension than three-eights of the overall thickness of slab, wall or beam in which they are embedded.
2. They shall not be spaced closer than three diameters or widths on center.
3. They shall not impair the strength of the construction.

1925.3.6 Conduits, pipes and sleeves may be considered as replacing structurally in compression the displaced concrete, provided:

1. They are not exposed to rusting or other deterioration.
2. They are of uncoated or galvanized iron or steel not thinner than standard Schedule 40 steel pipe, and
3. They have a nominal inside diameter not over 2 inches (51 mm) and are spaced not less than three diameters on centers.

1925.3.7 In addition to other requirements of Section 1925.3 pipes that will contain liquid, gas or vapor may be embedded in structural concrete under the following conditions:

1. Pipes and fittings shall be designed to resist effects of the material, pressure and temperature to which they will be subjected.
2. Temperature of liquid, gas or vapor shall not exceed 150°F (66°C).
3. Maximum pressure to which any piping or fittings shall be subjected shall not exceed 200 psi (1379 kPa) above atmospheric pressure.
4. All piping and fittings except as provided in Section 1925.3.5 shall be tested as a unit for leaks before concrete placement. Testing pressure above atmospheric pressure shall be 50 percent in excess of pressure to which piping and fittings may be subjected, but minimum testing pressure shall not be less than 150 psi (1034 kPa) above atmospheric pressure. Pressure test shall be held for 4 hours with no drop in pressure except that which may be caused by air temperature.
5. Drain pipes and other piping designed for pressures of not more than 1 psi (7 kPa) above atmospheric pressure need not be tested as required in Section 1925.3.7(4).
6. Pipes carrying liquid, gas or vapor that is explosive or injurious to health shall be tested again as specified in Section 1925.3.7(4) after concrete has hardened.
7. No liquid, gas or vapor, except water not exceeding 90°F (32°C) nor 50 psi (350 kPa) pressure, shall be placed in the pipes until the concrete has attained its design strength.
8. Unless piping in solid slabs is for radiant heating, it shall be placed between top and bottom reinforcement.
9. Concrete cover for pipes and fittings shall not be less than $1^1/_2$ inches (38 mm) for concrete exposed to earth or weather, nor $^3/_4$ inch (19 mm) for concrete not exposed to weather or in contact with ground.
10. Reinforcement with an area not less than 0.002 times the area of concrete section shall be provided normal to the piping.
11. Piping and fittings shall be assembled by welding, brazing, solder sweating or other equally satisfactory methods. Screw connections shall not be permitted. Piping shall be so fabricated and installed that cutting, bending or displacement of reinforcement from its proper location will not be required.

1925.4 Construction joints.

1925.4.1 Surfaces of the concrete construction joints shall be cleaned and laitance removed.

1925.4.2 Immediately before new concrete is placed, all construction joints shall be wetted and standing water removed.

1925.4.3 Construction joints shall be so made and located as not to impair the strength of the structure. Provision shall be made for transfer of shear and other forces through construction joints.

1925.4.4 Construction joints in floors shall be located near the middle of the spans of slabs, beams or girders, unless a beam intersects a girder at the middle location, in which case, joints in the girders shall be offset a distance approximately twice the width of the beam.

1925.4.5 Beams, girders or slabs supported by columns or walls shall not be cast or erected until concrete in the vertical support members is no longer plastic.

1925.4.6 Beams, girders, haunches, drop panels and capitals shall be placed monolithically as part of a slab system, unless otherwise shown on design drawing.

SECTION 1926
HIGH-VELOCITY HURRICANE ZONES—DETAILS OF REINFORCEMENT

1926.1 Bending reinforcement.

1926.1.1 All reinforcement shall be bent cold, unless otherwise permitted by the professional engineer.

1926.1.2 Reinforcement partially embedded in concrete shall not be field bent, except as shown on the design drawings or permitted by the professional engineer.

1926.2 Surface conditions of reinforcement.

1926.2.1 At the time concrete is placed, reinforcement shall be free from mud, oil or other nonmetallic coatings that adversely affect bonding capacity.

1926.2.2 Steel reinforcement, except prestressing tendons, with rust, mill scale or a combination of both shall be considered satisfactory, provided the minimum dimensions, including the height of deformations and weight of a hand-wire-brushed test specimen, are not less than applicable ASTM specification requirements.

1926.2.3 Prestressing tendons shall be clean and free of oil, dirt, scale, pitting and excessive ruts. A light oxide is permissible.

1926.3 Placing reinforcement.

1926.3.1 Steel reinforcement shall be accurately placed and adequately secured in position by concrete or metal chairs, spacers or other acceptable methods. The minimum clear distance between parallel bars, except in columns, shall be equal to the nominal diameter of the bars. In no case shall the clear distance between bars be less than 1 inch (25 mm), or less than one and one-third times the maximum size of the coarse aggregate. When reinforcement in beams or girders is placed in two or more layers, the clear distance between layers shall not be less than 1 inch (25 mm) nor less than the diameter of the bars, and the bars in the upper layers shall be placed directly above those in the bottom layer.

1926.3.2 Unless otherwise permitted by the building official and professional engineer, reinforcement, prestressing tendons and prestressing ducts shall be placed within the following tolerances:

1. Tolerance for depth, d, and minimum concrete cover in flexural members, walls and compression members shall be as follows, where d represents the distance from the extreme compression fiber to the centroid of the tension reinforcement:

	Tolerance on d	Tolerance on minimum concrete cover
d < 8 in.	+/- 3/8 in.	- 3/8 in.
d > 8 in.	+/- 1/2 in.	- 1/2 in.

Exceptions:

a. Tolerance for the clear distance to formed soffits shall be minus $^1/_4$ inch (6.3 mm).

b. Tolerance for cover shall not exceed minus one-third the minimum concrete cover required in the contract drawings nor less than 1 inch (25 mm) when exposed to weather.

2. Tolerance for longitudinal location of bends and ends of reinforcement shall be + 2 inches (+ 51 mm) except at discontinuous ends of members where tolerance shall be + $^1/_2$ inch (+ 12.7 mm).

1926.3.3 Welded wire fabric with a wire size not greater than W5 or D5 used in slabs not exceeding 10 feet (3 m) in span may be curved from a point near the top of the slab over the support to a point near the bottom of the slab at midspan, provided such reinforcement is either continuous over, or securely anchored at, the support.

1926.3.4 Welding of crossing bars shall not be permitted for assembly of reinforcement unless approved by the professional engineer of record.

1926.3.5 Spacing limits and concrete cover for reinforcement shall be shown on the design drawings.

1926.4 Splices in reinforcement.

1926.4.1 In slabs, beams and girders, splices in reinforcement at points of maximum stress shall be avoided wherever possible. Such splices, where used, shall be welded, lapped or otherwise fully developed, but, in any case, shall transfer the entire stress from bar to bar without exceeding the allowable bond and shear stresses. The minimum overlap for a lapped splice shall be 24 bar diameters, but not less than 12 inches (25 mm) for bars and in accordance with Section 12.15 and 12.16 of ACI 318. The clear distance between bars shall also apply to the clear distance from a contact splice and adjacent splices or bars.

1926.4.2 Reinforcement shall be spliced only as required or permitted on design drawings, or in specifications or as authorized by the professional engineer of record.

1926.4.3 Lap splices shall not be used for bars larger than #11 except as provided in ACI 318.

1926.4.4 Lap splices of bundled bars shall be based on the lap splice length required for individual bars within a bundle, increased 20 percent for a 3-bar bundle and 33 percent for a 4-bar bundle. Individual bar splices within a bundle shall not overlap.

1926.4.5 Bars spliced by noncontact lap splices in flexural members shall not be spaced transversely farther apart than one-fifth the required lap splice length, nor 6 inches (152 mm).

1926.4.6 Welded splices may be used, provided the metallurgical properties of the bars are suitable as determined by the professional engineer of record in accordance with AWS D1.4.

1926.4.7 End bearing splices.

1926.4.7.1 In bars required for compression only, compressive stress may be transmitted by bearing of square cut ends held in concentric contact by a suitable device.

1926.4.7.2 Bar ends shall terminate in flat surfaces within $1^1/_2$ degrees of a right angle to the axis of the bars and shall be fitted within 3 degrees of full bearing after assembly.

1926.4.7.3 End bearing splices shall be used only in members containing closed ties, closed stirrups or spirals.

1926.4.8 Welded splices in reinforcing bars shall be made by certified welders and shall comply with the Standard Structural Welding Code-Reinforcing Steel, AWS D1.4, as set forth in Chapter 35 of this code.

1926.5 Concrete protection for reinforcement (nonprestressed).

1926.5.1 The reinforcement of footings and other principal structural members in which the concrete is deposited against the ground shall have not less than 3 inches (76 mm) of concrete between it and the ground contact surface. If the concrete surfaces after removal of the forms are to be exposed to the weather or be in contact with the ground, the reinforcement shall be protected with not less than 2 inches (51 mm) of concrete for bars larger than No. 5 and $1^1/_2$ inches (38 mm) for No. 5 bars or smaller except as set forth in Section 1926.5.5.

1926.5.2 The concrete protective covering for reinforcement at surfaces not exposed directly to the ground or weather shall be not less than $^3/_4$ inch (19 mm) for slabs and wall; and not less than $1^1/_2$ inches (38 mm) for beams, girders and columns. In concrete ribbed floors in which the clear distance between ribs is not more than 30 inches (762 mm), the protection of reinforcement shall be at least $^3/_4$ inch (19 mm).

1926.5.3 Concrete protection for reinforcement shall in all cases be as least equal to the diameter of bars except for concrete slabs and joists as set forth herein.

1926.5.4 Exposed reinforcement bars intended for bonding with future extensions shall be protected from corrosion by concrete or other adequate covering.

1926.5.5 For exterior balcony slabs, slab surface shall be sloped $^1/_8$ unit in 12 units or greater to safeguard against ponding of water and slabs shall be designed and constructed in accordance with the provisions of ACI 318.

1926.5.6 Concrete cover for cast-in-place, precast and prestressed concrete shall be in accordance with ACI 318 if not otherwise specified in this section. When this code requires a thickness of cover for fire protection greater than the minimum concrete specified in ACI 318, the greater thickness shall be used.

1926.5.7 Exposed reinforcement, inserts and plates intended for bonding with future extensions shall be protected from corrosion.

SECTION 1927
HIGH-VELOCITY HURRICANE ZONES—PRECAST CONCRETE UNITS

1927.1 General.

1927.1.1 Precast concrete units shall comply with the minimum requirements set forth in this section, and the standard set forth in Section 1920.3.

1927.1.2 All precast concrete elements and their attachments (including imbedments) to the main structural frame shall be designed by, and bear the seal of a Florida-registered architect or a Florida-registered engineer, which architect or engineer shall be proficient in structural design. The design shall be based on rational analysis for loads set forth in Chapter 16 (High-Velocity Hurricane Zones). The architect/engineer of record may delegate this responsibility to a Florida-registered delegated engineer. In that case, shop drawings and design calculations prepared by such delegated engineer shall be reviewed and approved by the architect and the engineer of record.

1927.1.3 Only the material cast monolithically with the units at the time of manufacture shall be used in computing stresses unless adequate and approved shear transfer is provided.

1927.1.4 The building official may promulgate and set forth in writing such reasonable rules for requiring tests to be made by an approved laboratory as he may consider necessary to insure compliance with this code or uniformity of the products produced. The quantity of tests shall be based on consideration of safety or volume of output.

1927.1.5 The building official or his or her representative shall have free access to the plant of any producer at all hours of normal operation, and failure to permit such access shall be cause for revocation of approval.

1927.1.6 Failure of any product to satisfy in every respect the quality prescribed, or failure to conform with plans and specifications, shall be cause for rejection of the products.

1927.2 Statements of responsibilities of architects and professional engineers on design of structures using precast concrete components.

1927.2.1 The structural construction documents shall indicate the configuration of precast components and shall include details of supports, anchors and connections for those components. Permit documents shall include sufficient details describing the attachment of precast units (including imbedments) to the main structure.

1927.2.2 The precast permit documents shall bear the signature and seal of the professional architect or engineer charged with the responsibility of the design of the precast units. The architect or engineer of record may delegate this responsibility to a Florida-registered delegated engineer. In that case, shop drawings and design calculations prepared by such delegated engineer shall be reviewed and approved by the architect and/or the engineer of record as an indication that his or her intent has been understood and that the specified criteria have been used.

1927.2.3 The structural submittals shall include component details, calculations and fabrication and erection drawings. All such submittals shall identify the specific project.

1927.3 Aggregate. The maximum size of the aggregate for precast units shall be not larger than one-third of the narrowest dimension between sides of the forms of the member in which the unit is cast nor larger than three-fourths of the minimum clear spacing between reinforcing bars and sides of the forms, except that where concrete is placed by means of high frequency vibration, the maximum size of the aggregate shall not be larger than one-half of the narrowest dimension between sides of the form.

1927.4 Strength of concrete.

1927.4.1 Concrete for precast structural units made of crushed stone or other heavy aggregate shall have a compressive strength of not less than 2,500 psi (17 238 kPa) at 28 days.

1927.4.2 Concrete for precast units made of light weight aggregate concrete shall follow the general provisions of Section 1923.1.2 with consideration of the nature and limitations of the aggregate and the strength of the product.

1927.5 Workmanship.

1927.5.1 The mix, the gradation of the aggregate and the workability shall be such as to insure complete filling of the form and continuous intimate bond between the concrete and all steel.

1927.5.2 Handling and conveying before curing shall be reduced to a minimum. Machinery for this purpose should be so designed that the unit will not be subject to bending or shock which would produce incipient cracks or broken edges or corners. Precast units shall not be freely transported or placed until the concrete is at least 14 days old, if made with regular cement, or at least seven days old, if made with Type III cement, or until its strength, as established by definite tests, is at least 60 percent of the required 28-day strength.

1927.5.3 The use of precast structural units not complying with ACI requirements or having visible cracks, honeycomb, exposed reinforcing except at ends or, with a compressive section dimension more than 1/8 inch (3.1 mm) less than specified dimension shall not be permitted.

1927.6 Curing.

1927.6.1 No precast structural unit shall be removed from the form until the concrete has attained a compressive strength of 50 percent of the 28-day design strength but not less than 1,250 psi (8619 kPa) as verified by representative tests.

1927.6.2 Curing by high pressure steam, steam vapor or other accepted processes may be employed to accelerate the hardening of the concrete and to reduce the time of curing.

1927.6.3 To ensure the eventual placement of the units in the structure without damage, the handling shall be done in such a manner that bending shall be reduced to a minimum or prevented.

1927.7 Identification and marking. All joists, beams, girders and other units shall show some mark plainly indicating the top of the unit. This mark or symbol shall indicate the manufacturer, the date of manufacture and the length, size and type of reinforcing.

1927.8 Cutting of holes. No openings or channels not provided for in the structural design shall be made on the job without the specific approval of the professional engineer in accordance with his or her written, detailed instructions covering such work.

1927.9 Anchorage. Anchorage of all precast concrete units shall be designed, based on rational analysis, to transmit loads and other forces to the structural frame.

1927.10 Bridging. Joists shall be secured against lateral displacement by cast-in-place bridging, and such bridging shall be spaced not to exceed 32 times the width of the compression flange of the joist except that for roof systems, cast-in-place portland-concrete slabs embedding the top flanges not less than 1/2 inch (12.7 mm), or steel inserts cast in the joist heads to which bulb-tees supporting gypsum decks are welded, shall be accepted in lieu of bridging.

1927.11 Connections. All joints and connections will perform their function at all stages of loading without overstress and with proper safety factors against failure caused by overload. Loading conditions to be considered in the design of joints and connections are service loads, including wind forces, volume changes resulting from shrinkage, creep, and temperature change, reaction loads, and loading encountered in stripping forms, shoring and removal of shores, storage and transportation of members.

1927.12 Inspections.

1927.12.1 All structural precast units shall be inspected for quality control by an architect or professional engineer qualified to perform these inspections prior to the concrete placement at the casting yard.

1927.12.2 All structural precast units and their attachments to the main structure shall be inspected after erection, but before concealment. Such inspections shall be performed by a Florida registered architect or professional engineer.

SECTION 1928
HIGH-VELOCITY HURRICANE ZONES — PRESTRESSED CONCRETE

1928.1 Prestressed concrete, as defined in Section 1921, shall comply with this section.

1928.1.1 All prestressed structural items shall be designed by a registered professional engineer. Openings or channels not provided for in the structural design shall not be made on the job without the specific approval of the design professional engineer.

1928.1.2 The building official may promulgate and set forth in writing such reasonable rules for requiring tests to be made by an approved laboratory as he or she may consider necessary to insure compliance with this code or uniformity of the products produced.

1928.1.3 The building official or his or her representative shall have free access to the plant of any producer at all hours of normal operation. Failure to permit such access shall be cause for revocation of approval.

1928.1.4 Failure of any product to satisfy the quality prescribed or failure to conform to plans and specifications shall be cause for rejection of the product.

1928.2 Statements of responsibilities of architects and professional engineers on design of cast-in-place post-tensioned concrete structural systems.

1928.2.1 The structural construction documents shall show the magnitude and location of all prestressing forces and all design assumptions.

1928.2.2 The structural engineer of record and/or the architect of record shall require the submission of calculations and installation drawings from a specialty engineer for post-tensioning systems for review by the structural engineer of record and/or the architect of record. Review is an indication that his or her intent has been understood and that

the specified criteria have been used. The installation drawings shall provide full details of materials to be used including necessary accessories and instructions for construction and shall identify the specific project and shall bear the impressed seal, signature and date of the specialty engineer who prepared them.

1928.2.3 It is the responsibility of the structural engineer of record and/or the architect of record to review the post-tensioning system installation drawings so that the drawings are coordinated with the reinforcing steel shop drawings.

1928.2.4 Determining the effect of post-tensioning on other parts of the building is the responsibility of the structural engineer of record and/or the architect of record.

1928.3 Design and construction.

1928.3.1 Design and construction shall be in accordance with Chapter 18 of ACI 318.

1928.3.2 Calcium chloride shall not be used in concrete for prestressed members.

1928.4 Tendon and anchorage zones.

1928.4.1 Reinforcement shall be provided where required in tendon anchorage zones to resist bursting, splitting, and spalling forces induced by tendon anchorage. Regions of abrupt change in section shall be adequately reinforced.

1928.4.2 End blocks shall be provided where required for support bearing or for distribution of concentrated prestressing forces.

1928.4.3 Post-tensioning anchorage and supporting concrete shall be designed to resist maximum jacking force for strength of concrete at time of prestressing.

1928.4.4 Post-tensioning anchorage zones shall be designed to develop the guaranteed ultimate tensile strength of prestressing tendons using a strength reduction factor of 0.90 for concrete.

1928.5 Corrosion protection for unbonded prestressing tendons.

1928.5.1 Unbonded tendons shall be completely coated with suitable material to ensure corrosion protection.

1928.5.2 Tendon wrapping shall be continuous over the entire length to be unbonded, and shall prevent intrusion of cement paste or loss of coating materials during concrete placement.

1928.6 Post-tensioning ducts.

1928.6.1 Ducts for grouted or unbonded tendons shall be mortar-tight and nonreactive with concrete, tendons or filler material.

1928.6.2 Ducts for grouted single wire, strand or bar tendons shall have an inside diameter at least $^1/_4$ inch (6.3 mm) larger than tendon diameter.

1928.6.3 Ducts for grouted multiple wire, strand or bar tendons shall have an inside cross-sectional area at least two times the net area of the tendons.

1928.7 Grout for prestressing tendons.

1928.7.1 Grout shall consist of portland cement and water; or Portland cement, sand and water.

1928.7.2 Materials for grout shall conform as specified in ACI 318 and be as follows:

1. Portland cement.
2. Water content shall be minimum necessary for proper pumping of grout; however, water-cement ratio shall not exceed 0.45 by weight.
3. Sand, if used, shall conform to Standard Specifications for Aggregate for Masonry Mortar, ASTM C 144, except that gradation may be modified as necessary to obtain satisfactory workability.
4. Admixtures conforming to ACI 318 and known to have no injurious effects on grout, steel or concrete may be used. Calcium chloride shall not be used.
5. Water shall not be added to increase grout flowability that has been decreased by delayed use of grout.
6. Grout temperatures shall not be above 90°F (32°C) during mixing and pumping.

1928.8 Protection for prestressing tendons. Burning or welding operations in the vicinity of prestressing tendons shall be carefully performed, so that tendons are not subject to excessive temperatures, welding sparks or ground currents.

1928.9 Application and measurement of prestressing force.

1928.9.1 Prestressing force shall be determined by both of the following methods and the cause of any difference in force determination that exceeds 5 percent shall be ascertained and corrected.

1. Measurement of tendon elongation. Required elongation shall be determined from average load-elongation curves for prestressing tendons used.
2. Observation of jacking force on a calibrated gauge or load cell or by use of a calibrated dynamometer.

1928.9.2 Where transfer of force from bulkheads or pretensioning bed to concrete is accomplished by flame cutting prestressing tendons, cutting points and cutting sequence shall be predetermined to avoid undesired temporary stresses.

1928.9.3 Long lengths of exposed pretensioned strand shall be cut near the member to minimize shock to concrete.

1928.9.4 Total loss of prestress as a result of unreplaced broken tendons shall not exceed 2 percent of total prestress.

1928.10 Post-tensioning anchorages and couplers.

1928.10.1 Couplers shall be placed in areas approved by the professional engineer and enclosed in housing long enough to permit necessary movements.

1928.10.2 In unbonded construction subject to repetitive loads, special attention shall be given to the possibility of fatigue in anchorages and couplers.

1928.10.3 Anchorage and end fittings shall be permanently protected against corrosion.

SECTION 1929
HIGH-VELOCITY HURRICANE ZONES—PNEUMATICALLY PLACED CONCRETE (SHOTCRETE)

1929.1 General.

1929.1.1 Pneumatically placed concrete is a proportioned combination of fine aggregate portland cement and water which, after mixing, is pneumatically projected by air directly onto the surface to which it is to be applied.

1929.1.2 Pneumatically placed concrete shall conform to all requirements of Specifications for Materials, Proportioning and Application of Shotcrete, ACI 506.2 published by the American Concrete Institute, except as modified herein.

1929.1.3 Pneumatically placed concrete shall be composed of Portland cement, aggregate and water proportioned to produce a concrete suitable for pneumatic application.

1929.1.4 Concrete ingredients shall be selected and proportioned in a manner that will produce concrete which will be extremely strong, dense and resistant to weathering and abrasion.

1929.2 Sampling and testing cement and aggregate. The contractor shall determine the source, kind and quality of the cement and aggregates to be used in the work well in advance of the time scheduled for starting the work and when so directed by the building official shall submit such information for approval before starting shotcrete operation.

1929.3 Surface preparation. To insure adequate bond, the newly chipped and sandblasted surface shall be thoroughly moistened with water prior to application of shotcrete. In no instance shall shotcrete be applied in an area where free running water exists.

1929.4 Proportioning. Prior to the start of shotcreting, the contractor shall submit to the professional engineer the recommended mix as a ratio of cement to aggregate. The recommended mix shall be on the basis of test data from prior experience.

1929.5 Mixing.

1929.5.1 Shotcrete shall be thoroughly mixed by machine and then passed through a sieve to remove all large particles before placing in the hopper of the cement gun. The mixture shall not be permitted to become damp. Each batch should be entirely discharged before recharging is begun. The mixer should be cleaned thoroughly enough to remove all adherent materials from the mixing vanes and from the drum at regular intervals.

1929.5.2 Water in any amount shall not be added to the mix before it enters the cement gun. Quantities of water shall be controlled by a valve at the nozzle of the gun. Water content shall be adjusted as required for proper placement, but shall in no case exceed 4 gallons (15 L) of water per sack of cement, including the water contained in the aggregate.

1929.5.3 Remixing or tempering shall not be permitted. Mixed material that has stood 45 minutes without being used shall be discarded. Rebound materials shall not be reused.

1929.6 Application.

1929.6.1 In shooting walls and columns, application shall begin at the bottom and the first coat shall completely embed the reinforcement to the form.

1929.6.2 In shooting beams, application shall begin at the bottom and a surface at right angles to the nozzle shall be maintained.

1929.6.3 In shooting slabs, the nozzle shall be held at a slight angle to the work so that rebound is blown on to the finished portion where it shall be removed.

1929.6.4 Corners shall be filled first. "Shooting" shall be from an angle as near perpendicular to the surface as practicable, with the nozzle held approximately 3 feet (915 mm) from the work, except in confined control. If the flow of material at the nozzle is not uniform and slugs, sand spots or wet sloughs result, the nozzle person shall direct the nozzle away from the work until the faulty conditions are corrected. Such defects shall be replaced as the work progresses.

1929.6.5 Shotcreting shall be suspended if:

1. Air velocity separates the cement from the sand at the nozzle.
2. Temperature approaches freezing and the newly placed shotcrete cannot be protected.

1929.6.6 The time interval between successive layers in sloping, vertical or overhanging work must be sufficient to allow initial but not final set to develop. At the time the initial set is developing, the surface shall be cleaned to remove the thin film of laitance in order to provide a good bond with succeeding applications.

1929.7 Construction joints. Construction joints or day's work joints shall be sloped off to a thin, clean, regular edge, preferably at a 45 degree (0.78 rad) slope. Before placing the adjoining work, the slope portion and adjacent shotcrete shall be thoroughly cleaned as necessary, then moistened and scoured with an air jet.

1929.8 Curing and protection.

1929.8.1 Curing shall be in accordance with ACI 506.2 depending upon atmospheric condition.

1929.8.2 Immediately after placement, shotcrete shall be maintained in a moist condition for at least the first 24 hours.

1929.8.3 Final curing shall continue for seven days after placement if Type I Portland cement is used, or for three days if high-early-strength Type III Portland cement is used, or until the specified strength is attained. Final curing may consist of the initial curing process or an approved moisture-retaining covering.

1929.8.4 Natural curing may be used when relative humidity remains above 85 percent when approved by the professional engineer of record.

CHAPTER 20
ALUMINUM

SECTION 2001
GENERAL

2001.1 Scope. Provisions of this chapter shall govern the quality, design, fabrication and erection of aluminum alloys used in building construction.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Section 2003.

SECTION 2002
MATERIALS

2002.1 General. The quality, design, fabrication and erection of aluminum used structurally in buildings or structures shall conform to good engineering practice, the provisions of this chapter and other applicable requirements of this code.

Exception: All buildings located within the high-velocity hurricane zone shall comply with the requirements of Section 2003.

2002.2 Structural aluminum construction. The design, fabrication and assembly of structural aluminum for buildings or structures shall conform to AA ASM 35 and Specifications for Aluminum Structures, Aluminum Design Manual, Part 1-A and 1-B, of the Aluminum Association. The use of aluminum alloys not listed in the manual shall be permitted provided their standard of performance is not less than those required in the manual and the performance is substantiated to the satisfaction of the building official.

2002.2.1 Definitions

PRIMARY MEMBER. Structural framing members providing structural support to other members and/or surfaces of a structure including, but not limited to beams, posts, columns, joists, structural gutters, headers, eave rail, purlins, roof brace.

SECONDARY MEMBERS. Structural framing members which do not provide basic support for the entire structure, generally including, but not limited to, such members as kickplate rails, chair rails, roof or wall panels, wall brace.

STRUCTURAL MEMBERS. Members or sections that provide support to an assembly and/or resist applied loads.

2002.3 Screen enclosures.

2002.3.1 Actual wall thickness of extruded aluminum members shall be not less than 0.040 inch (1 mm).

2002.3.2 Reserved.

2002.3.3 Vinyl and acrylic panels shall be removable. Removable panels shall be identified as removable by a decal. The identification decal shall essentially state "Removable panel SHALL be removed when wind speeds exceed 75 mph (34 m/s)." Decals shall be placed such that the decal is visible when the panel is installed.

2002.4 Loads. Structural members supporting screened enclosures shall be designed for wind in either of two orthogonal directions using the pressures given in Table 2002.4. Each primary member shall also be designed for a 300 pound (1.33 kN) load applied vertically downward along any 1 foot (305 Mm) of any member, not occurring simultaneously with wind load.

2002.4.1 The following design guides shall be accepted as conforming to accepted engineering practices:

AAF Guide to Aluminum Construction in High Wind Areas.

2002.5 Wall panels. The minimum thickness for formed sheet aluminum structural wall panels shall be not less than 0.024 inch (0.6 mm), subject to approved tolerances.

2002.6 Sunrooms. Sunrooms shall comply with AAMA/NPEA/NSA 2100 with the structural requirements and testing provisions of Chapter 5 modified to incorporate ASCE 7. Sunrooms shall be categorized in one of the following categories.

Category I: A roof or a covering of an outdoor space. The openings shall be permitted to be enclosed with insect screening or 0.5 mm (20 mil) maximum thickness plastic film. The space is defined as nonhabitable and unconditioned.

Category II: A roof or a covering of an outdoor space with enclosed walls. The openings are permitted to be enclosed with translucent or transparent plastic or glass. The space is defined as nonhabitable and unconditioned.

Category III: A roof or a covering of an outdoor space with enclosed walls. The openings are permitted to be enclosed with translucent or transparent plastic or glass. The sunroom complies with additional requirements for forced-entry resistance, air-leakage resistance and water-penetration resistance. The space is defined as nonhabitable and unconditioned.

Category IV: A roof or a covering of an outdoor space with enclosed walls. The sunroom is designed to be heated and/or cooled by a separate temperature control or system and is thermally isolated from the primary structure. The sunroom complies with additional requirements for forced-entry resistance, water-penetration resistance, air-leakage resistance, and thermal performance. The space is defined as habitable and conditioned.

Category V: A roof or a covering of an outdoor space with enclosed walls. The sunroom is designed to be heated and/or cooled and is open to the main structure. The sunroom complies with additional requirements for forced-entry resistance, water-penetration resistance, air-leakage resistance, and thermal performance. The space is defined as habitable and conditioned.

TABLE 2002.4
DESIGN WIND PRESSURES FOR ALUMINUM SCREENED ENCLOSURES[a,b,c]

SURFACE	BASIC WIND SPEED (mph)											
	100		110		120		130		140		150	
	Exposure Category (B or C) Design Pressure (psf)											
	B	C	B	C	B	C	B	C	B	C	B	C
Horizontal Pressure on Windward Surfaces	12	17	13	18	15	21	18	25	21	29	24	33
Horizontal Pressure on Leeward Surfaces	10	13	10	14	13	17	14	19	15	23	18	27
Vertical Pressure - Screen Surfaces	3	5	4	5	4	6	5	7	6	8	7	9
Vertical Pressure - Solid Surfaces	10	14	11	15	13	18	15	21	17	24	20	28

For SI: 1 pound per square foot = 9.479 kN/m^2.

NOTES:

a. Pressures include importance factors determined in accordance with Table 1604.5.
b. Pressures apply to enclosures with a mean enclosure roof height of 30 feet (10 m). For other heights, multiply the pressures in this table by the factors in Table 2002.4A.
c. Apply horizontal pressures to the area of the enclosure projected on a vertical plane normal to the assumed wind direction, simultaneously inward on the windward side and outward on the leeward side.
d. Apply vertical pressures upward and downward to the area of the enclosure projected on a horizontal plane.
e. Apply horizontal pressures simultaneously with vertical pressures.
f. Table pressures are MWFRS Loads. The design of solid roof panels and their attachments shall be based on component and cladding loads for enclosed or partially enclosed structures as appropriate.
g. Table pressures apply for all screen densities up to 20×20×.013" mesh. For greater densities use pressures for enclosed buildings.
h. Table pressures may be interpolated using ASCE 7 methodology.

SECTION 2003
HIGH-VELOCITY HURRICANE ZONES—ALUMINUM

2003.1 Design. Aluminum members shall be designed by methods admitting of rational analysis according to established principles of mechanics.

2003.2 Standards. The design, fabrication, and erection of structural aluminum shall conform to the Aluminum Design Manual.

2003.3 Workmanship. Aluminum construction shall be in conformance with the tolerances, quality and methods of construction as set forth in Section 2003.2 and the American Welding Society's Structural Welding Code-Aluminum (D1.2).

2003.4 Definitions. Members shall be defined as in Section 2002.2.1.

2003.5 Identification. Aluminum for structural elements shall at all times be segregated or otherwise handled in the fabricator's plant so that the separate alloys and tempers are positively identified and, after completion of fabrication, shall be marked to identify the alloy and temper. Such markings shall be affixed to complete members and assemblies or to boxed or bundled shipments of multiple units prior to shipment from the fabricator's plant.

Exception: Certification by the fabricator and or contractor shall be provided attesting to the alloy and temper of the material.

TABLE 2002.4A
HEIGHT ADJUSTMENT FACTORS

MEAN ROOF HEIGHT	EXPOSURE	
	B	C
15	1	0.86
20	1	0.92
25	1	0.96
30	1	1.00
35	1.05	1.03
40	1.09	1.06
45	1.12	1.09
50	1.16	1.11
55	1.19	1.14
60	1.22	1.16

2003.6 Allowable unit stresses.

2003.6.1 The design, fabrication and assembly of aluminum members for building and other structures shall conform to the standard set forth in Section 2003.2 and as otherwise set forth herein.

2003.6.2 The use of aluminum alloys, other than those listed in the standard shall provide performance not less than those required by the standard and as set forth herein.

2003.6.3 Aluminum members shall be limited by the deflections set forth in Section 1613.

2003.7 The building official may require that any structure using aluminum primary or secondary members be designed by a Florida-registered professional engineer.

2003.7.1 Reserved.

2003.7.2 In addition to flexural and shearing stresses, the critical factors of buckling, fatigue, stress raisers such as notches or holes or shape re-entrant corners, deflection and connections shall be considered and provided for by proper design.

2003.7.3 All solid roof systems shall be designed for a minimum 30 psf (1436 Pa) live load.

2003.7.4 All buildings and structures shall be designed to resist uplift. In the case of placement on existing slabs and foundations, sufficient information and calculations shall be provided by the professional engineer and/or architect to verify the ability of the slab or foundation to resist uplift loads.

2003.7.5 All connection devices shall be rated by load testing by an approved testing laboratory.

2003.7.5.1 All expansion anchors shall not be installed less than 3 inches (76 mm) from the edge of concrete slab and/or footings. All expansion anchors shall develop an ultimate withdrawal resisting force equal to four times the imposed load, with no stress increase for duration of load.

2003.8 Fabrication and construction details.

2003.8.1 Connections. Aluminum members shall be designed as set forth in the standards in Section 2003.2.

2003.8.1.1 Fasteners. Bolts and other fasteners shall be aluminum, stainless steel, hot-dip or electro-galvanized steel. Double cadmium plated steel bolts may also be used.

2003.8.1.2 Painting. Except as prescribed in Section 2003.8.4, painting or coating of aluminum alloy parts shall be required only when called for on the plans.

2003.8.1.3 Welding. Aluminum parts shall be welded with an inert-gas-shielded arc or resistance welding process. No welding process that requires a welding flux shall be used. Filler alloys complying with the requirements of the standard in this chapter shall be used.

2003.8.1.4 Welder qualifications. All welding of structural aluminum member shall be performed by certified welders.

2003.8.1.5 Erection. During erection, structural aluminum shall be adequately braced and fastened to resist dead, wind and erection loads.

2003.8.2 Structural aluminum decking and siding.

2003.8.2.1 Aluminum sections spanning between supports shall be limited in span to satisfactorily support the positive and negative loads set forth in Chapter 16 (High-Velocity Hurricane Zones). The deflection of decking shall not exceed that set forth in Section 1613.

2003.8.2.2 Aluminum sheet used for roof decking or siding shall be not less than 0.032 inch (0.8 mm) in thickness.

2003.8.2.3 Aluminum sheets shall be secured to the supports to adequately resist positive and negative loads. Attachments shall be at intervals not exceeding 8 inches (203 mm) o.c. and shall be secured to each other at side laps at intervals as required by rational analysis and/or tests, but shall not exceed 12 inches (305 mm) o.c.

2003.8.2.4 Fasteners shall have a head, and/or be provided with washers not less than $^1/_2$ inch (13 mm) in diameter.

2003.8.2.5 Fasteners located at end laps shall be placed not more than 2 inches (51 mm) nor less than 1 inch (25 mm) from the end of overlapping sheets.

2003.8.2.6 Where roof or wall cladding is of aluminum, an approved membrane to protect against water intrusion to the interior shall be provided or the aluminum cladding shall be designed and constructed with an approved continuous edge-interlock, overlap or seam to prevent water intrusion.

2003.8.3 Nonstructural aluminum decking and siding.

2003.8.3.1 Nonstructural aluminum sheets shall be backed with cladding as set forth in Chapter 23 and Chapter 24 (High-Velocity Hurricane Zones).

2003.8.3.2 Nonstructural aluminum sheets shall have a minimum thickness of 0.032 inches (0.8 mm).

2003.8.3.3 An approved membrane to protect against water intrusion shall be provided or the aluminum cladding shall be designed and constructed with an approved continuous edge-interlock, overlap or seam to prevent water intrusion.

2003.8.3.4 Nonstructural decking and siding shall be attached as set forth in Section 2003.8.2 except that the attachment of aluminum residential siding shall be by rational analysis and/or tests using a minimum 0.120-inch (3 mm) diameter aluminum nails of sufficient length to penetrate studs a minimum of 2 inches (51 mm). Nails at wood studs shall be as required by rational analysis and/or tests, but spaced not greater than 24 inches (610 mm) o.c. horizontally and no greater than 8 inches (203 mm) o.c. vertically.

2003.8.4 Dissimilar materials.

2003.8.4.1 Aluminum may contact compatible metals such as, but not limited to:

1. Nonmagnetic stainless steel provided the contacting surfaces and any attachments are enclosed for protection from the weather.
2. Zinc.
3. White bronze.

2003.8.4.2 Aluminum contacting metals not considered compatible shall be protected as follows:

1. Painting the dissimilar metal with a prime coat of zinc-chromate primer or other suitable primer, followed by one or two coats of aluminum metal-and-masonry paint or other suitable protective coating, excluding those containing lead pigmentation.
2. Painting the dissimilar metal with a coating of a heavy-bodied bituminous paint.
3. Placing a good quality caulking material between the aluminum and the dissimilar metal.
4. Applying a nonabsorptive tape or gasket.
5. Hot-dip galvanizing or zinc-plating steel members after fabrication.

2003.8.4.3 Dissimilar metals shall be painted if used in locations where drainage from them passes over aluminum.

2003.8.4.4 Aluminum surfaces in contact with lime-mortar, concrete, or other masonry materials, shall be protected with alkali-resistant coatings, such as heavy-bodied bituminous paint or water-white methacrylate lacquer.

2003.8.4.5 Aluminum in contact with wood or other absorbing materials which may become repeatedly wet shall be painted with two coats of aluminum metal-and-masonry paint or a coat of heavy-bodied bituminous paint, or the wood or other absorbing material shall be painted with two coats of aluminum house paint and the joints sealed with a good quality caulking compound.

2003.8.4.6 Where aluminum is in contact with treated wood, wood shall be treated with pentachlorophenol, 5 percent minimum concentration, creosote, or zinc naphthanate, following the protective measures outlined in Section 2003.8.4.5.

2003.8.5 Expansion and contraction. Aluminum work shall be designed and anchored so the work will not be distorted nor the fasteners overstressed from the expansion and contraction of the metal.

CHAPTER 21
MASONRY

SECTION 2101
GENERAL

2101.1 Scope. This chapter shall govern the materials, design, construction and quality of masonry.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Section 2114 and Sections 2118 through 2122.

2101.2 Design methods. Masonry shall comply with the provisions of one of the following design methods in this chapter as well as the requirements of Sections 2101 through 2104. Masonry designed by the allowable stress design provisions of Section 2101.2.1, the strength design provisions of Section 2101.2.2 or the prestressed masonry provisions of Section 2101.2.3 shall comply with Section 2105.

2101.2.1 Allowable stress design. Masonry designed by the allowable stress design method shall comply with the provisions of Section 2107.

2101.2.2 Strength design. Masonry designed by the strength design method shall comply with the provisions of Section 2108, except that autoclaved aerated concrete (AAC) masonry shall comply with the provisions of Chapter 1 and Appendix A of ACI 530/ASCE 5/TMS 402.

2101.2.3 Prestressed masonry. Prestressed masonry shall be designed in accordance with Chapters 1 and 4 of ACI 530/ASCE 5/TMS 402.

2101.2.4 Empirical design. Masonry designed by the empirical design method shall comply with the provisions of Section 2109 or Chapter 5 of ACI 530/ASCE 5/TMS 402.

2101.2.5 Glass unit masonry. Glass unit masonry shall comply with the provisions of Section 2110 or Chapter 7 of ACI 530/ASCE 5/ TMS 402.

2101.2.6 Masonry veneer. Masonry veneer shall comply with the provisions of Chapter 14 or Chapter 6 of ACI 530/ASCE 5/TMS 402.

2101.2.7 Prescriptive methods. Masonry construction is permitted in accordance with applicable standards referenced in Section 1609.1.1.

2101.3 Construction documents. The construction documents shall show all of the items required by this code including the following:

1. Specified size, grade, type and location of reinforcement, anchors and wall ties.
2. Reinforcing bars to be welded and welding procedure.
3. Size and location of structural elements.
4. Provisions for dimensional changes resulting from elastic deformation, creep, shrinkage, temperature and moisture.

2101.3.1 Fireplace drawings. The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be clearly indicated.

SECTION 2102
DEFINITIONS AND NOTATIONS

2102.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

AAC MASONRY. Masonry made of autoclaved aerated concrete (AAC) units, manufactured without internal reinforcement and bonded together using thin- or thick-bed mortar.

ADOBE CONSTRUCTION. Construction in which the exterior load-bearing and nonload-bearing walls and partitions are of unfired clay masonry units, and floors, roofs and interior framing are wholly or partly of wood or other approved materials.

Adobe, stabilized. Unfired clay masonry units to which admixtures, such as emulsified asphalt, are added during the manufacturing process to limit the units' water absorption so as to increase their durability.

Adobe, unstabilized. Unfired clay masonry units that do not meet the definition of "Adobe, stabilized."

ANCHOR. Metal rod, wire or strap that secures masonry to its structural support.

ARCHITECTURAL TERRA COTTA. Plain or ornamental hard-burned modified clay units, larger in size than brick, with glazed or unglazed ceramic finish.

AREA.

Bedded. The area of the surface of a masonry unit that is in contact with mortar in the plane of the joint.

Gross cross-sectional. The area delineated by the out-to-out specified dimensions of masonry in the plane under consideration.

Net cross-sectional. The area of masonry units, grout and mortar crossed by the plane under consideration based on out-to-out specified dimensions.

AUTOCLAVED AERATED CONCRETE (AAC). Low-density cementitious product of calcium silicate hydrates, whose material specifications are defined in ASTM C 1386.

BED JOINT. The horizontal layer of mortar on which a masonry unit is laid.

BOND BEAM. A horizontal grouted element within masonry in which reinforcement is embedded.

BOND REINFORCING. The adhesion between steel reinforcement and mortar or grout.

BRICK.

Calcium silicate (sand lime brick). A masonry unit made of sand and lime.

Clay or shale. A masonry unit made of clay or shale, usually formed into a rectangular prism while in the plastic state and burned or fired in a kiln.

Concrete. A masonry unit having the approximate shape of a rectangular prism and composed of inert aggregate particles embedded in a hardened cementitious matrix.

BUTTRESS. A projecting part of a masonry wall built integrally therewith to provide lateral stability.

CAST STONE. A building stone manufactured from portland cement concrete precast and used as a trim, veneer or facing on or in buildings or structures.

CELL. A void space having a gross cross-sectional area greater than $1^1/_2$ square inches (967 mm^2).

CHIMNEY. A primarily vertical enclosure containing one or more passageways for conveying flue gases to the outside atmosphere.

CHIMNEY TYPES.

High-heat appliance type. An approved chimney for removing the products of combustion from fuel-burning, high-heat appliances producing combustion gases in excess of 2,000°F (1093°C) measured at the appliance flue outlet (see Section 2113.11.3).

Low-heat appliance type. An approved chimney for removing the products of combustion from fuel-burning, low-heat appliances producing combustion gases not in excess of 1,000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1,400°F (760°C) during intermittent forces firing for periods up to 1 hour. Temperatures shall be measured at the appliance flue outlet.

Masonry type. A field-constructed chimney of solid masonry units or stones.

Medium-heat appliance type. An approved chimney for removing the products of combustion from fuel-burning, medium-heat appliances producing combustion gases not exceeding 2,000°F (1093°C) measured at the appliance flue outlet (see Section 2113.11.2).

CLEANOUT. An opening to the bottom of a grout space of sufficient size and spacing to allow the removal of debris.

COLLAR JOINT. Vertical longitudinal joint between wythes of masonry or between masonry and backup construction that is permitted to be filled with mortar or grout.

COLUMN, MASONRY. An isolated vertical member whose horizontal dimension measured at right angles to its thickness does not exceed three times its thickness and whose height is at least four times its thickness.

COMPOSITE ACTION. Transfer of stress between components of a member designed so that in resisting loads, the combined components act together as a single member.

COMPOSITE MASONRY. Multiwythe masonry members acting with composite action.

COMPRESSIVE STRENGTH OF MASONRY. Maximum compressive force resisted per unit of net cross-sectional area of masonry, determined by the testing of masonry prisms or a function of individual masonry units, mortar and grout.

CONNECTOR. A mechanical device for securing two or more pieces, parts or members together, including anchors, wall ties and fasteners.

COVER. Distance between surface of reinforcing bar and edge of member.

DIAPHRAGM. A roof or floor system designed to transmit lateral forces to shear walls or other lateral-load-resisting elements.

DIMENSIONS.

Actual. The measured dimension of a masonry unit or element.

Nominal. The specified dimension plus an allowance for the joints with which the units are to be laid. Thickness is given first, followed by height and then length.

Specified. The dimensions specified for the manufacture or construction of masonry, masonry units, joints or any other component of a structure.

EFFECTIVE HEIGHT. For braced members, the effective height is the clear height between lateral supports and is used for calculating the slenderness ratio. The effective height for unbraced members is calculated in accordance with engineering mechanics.

FIREPLACE. A hearth and fire chamber or similar prepared place in which a fire may be made and which is built in conjunction with a chimney.

FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

FOUNDATION PIER. An isolated vertical foundation member whose horizontal dimension measured at right angles to its thickness does not exceed three times its thickness and whose height is equal to or less than four times its thickness.

GLASS UNIT MASONRY. Masonry composed of glass units bonded by mortar.

GROUTED MASONRY.

Grouted hollow-unit masonry. That form of grouted masonry construction in which certain designated cells of hollow units are continuously filled with grout.

Grouted multiwythe masonry. That form of grouted masonry construction in which the space between the wythes is solidly or periodically filled with grout.

HEAD JOINT. Vertical mortar joint placed between masonry units within the wythe at the time the masonry units are laid.

HEADER (Bonder). A masonry unit that connects two or more adjacent wythes of masonry.

HEIGHT, WALLS. The vertical distance from the foundation wall or other immediate support of such wall to the top of the wall.

MASONRY. A built-up construction or combination of building units or materials of clay, shale, concrete, glass, gypsum,

stone or other approved units bonded together with or without mortar or grout or other accepted methods of joining.

Ashlar masonry. Masonry composed of various-sized rectangular units having sawed, dressed or squared bed surfaces, properly bonded and laid in mortar.

Coursed ashlar. Ashlar masonry laid in courses of stone of equal height for each course, although different courses shall be permitted to be of varying height.

Glass unit masonry. Masonry composed of glass units bonded by mortar.

Plain masonry. Masonry in which the tensile resistance of the masonry is taken into consideration and the effects of stresses in reinforcement are neglected.

Random ashlar. Ashlar masonry laid in courses of stone set without continuous joints and laid up without drawn patterns. When composed of material cut into modular heights, discontinuous but aligned horizontal joints are discernible.

Reinforced masonry. Masonry construction in which reinforcement acting in conjunction with the masonry is used to resist forces.

Solid masonry. Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar.

Unreinforced (plain) masonry. Masonry in which the tensile resistance of masonry is taken into consideration and the resistance of the reinforcing steel, if present, is neglected.

MASONRY UNIT. Brick, tile, stone, glass block or concrete block conforming to the requirements specified in Section 2103.

Clay. A building unit larger in size than a brick, composed of burned clay, shale, fired clay or mixtures thereof.

Concrete. A building unit or block larger in size than 12 inches by 4 inches by 4 inches (305 mm by 102 mm by 102 mm) made of cement and suitable aggregates.

Hollow. A masonry unit whose net cross-sectional area in any plane parallel to the load-bearing surface is less than 75 percent of its gross cross-sectional area measured in the same plane.

Solid. A masonry unit whose net cross-sectional area in every plane parallel to the load-bearing surface is 75 percent or more of its gross cross-sectional area measured in the same plane.

MEAN DAILY TEMPERATURE. The average daily temperature of temperature extremes predicted by a local weather bureau for the next 24 hours.

MORTAR. A plastic mixture of approved cementitious materials, fine aggregates and water used to bond masonry or other structural units.

MORTAR, SURFACE-BONDING. A mixture to bond concrete masonry units that contains hydraulic cement, glass fiber reinforcement with or without inorganic fillers or organic modifiers and water.

PLASTIC HINGE. Reserved.

PRESTRESSED MASONRY. Masonry in which internal stresses have been introduced to counteract potential tensile stresses in masonry resulting from applied loads.

PRISM. An assemblage of masonry units and mortar with or without grout used as a test specimen for determining properties of the masonry.

RUBBLE MASONRY. Masonry composed of roughly shaped stones.

Coursed rubble. Masonry composed of roughly shaped stones fitting approximately on level beds and well bonded.

Random rubble. Masonry composed of roughly shaped stones laid without regularity of coursing but well bonded and fitted together to form well-divided joints.

Rough or ordinary rubble. Masonry composed of unsquared field stones laid without regularity of coursing but well bonded.

RUNNING BOND. The placement of masonry units such that head joints in successive courses are horizontally offset at least one-quarter the unit length.

SHEAR WALL. A wall designed to resist lateral forces parallel to the plane of the wall.

Detailed plain masonry shear wall. Reserved.

Intermediate prestressed masonry shear wall. Reserved.

Intermediate reinforced masonry shear wall. Reserved.

Ordinary plain masonry shear wall. Reserved.

Ordinary plain prestressed masonry shear wall. Reserved.

Ordinary reinforced masonry shear wall. Reserved.

Special prestressed masonry shear wall. Reserved.

Special reinforced masonry shear wall. Reserved.

SHELL. The outer portion of a hollow masonry unit as placed in masonry.

SPECIFIED. Required by construction documents.

SPECIFIED COMPRESSIVE STRENGTH OF MASONRY, f'_m. Minimum compressive strength, expressed as force per unit of net cross-sectional area, required of the masonry used in construction by the construction documents, and upon which the project design is based. Whenever the quantity f'_m is under the radical sign, the square root of numerical value only is intended and the result has units of pounds per square inch (psi) (MPa).

STACK BOND. The placement of masonry units in a bond pattern is such that head joints in successive courses are vertically aligned. For the purpose of this code, requirements for stack bond shall apply to masonry laid in other than running bond.

STONE MASONRY. Masonry composed of field, quarried or cast stone units bonded by mortar.

Ashlar stone masonry. Stone masonry composed of rectangular units having sawed, dressed or squared bed surfaces and bonded by mortar.

Rubble stone masonry. Stone masonry composed of irregular-shaped units bonded by mortar.

STRENGTH.

Design strength. Nominal strength multiplied by a strength reduction factor.

Nominal strength. Strength of a member or cross section calculated in accordance with these provisions before application of any strength-reduction factors.

Required strength. Strength of a member or cross section required to resist factored loads.

THIN-BED MORTAR. Mortar for use in construction of AAC unit masonry with joints 0.06 inch (1.5 mm) or less.

TIE, LATERAL. Loop of reinforcing bar or wire enclosing longitudinal reinforcement.

TIE, WALL. A connector that connects wythes of masonry walls together.

TILE. A ceramic surface unit, usually relatively thin in relation to facial area, made from clay or a mixture of clay or other ceramic materials, called the body of the tile, having either a "glazed" or "unglazed" face and fired above red heat in the course of manufacture to a temperature sufficiently high enough to produce specific physical properties and characteristics.

TILE, STRUCTURAL CLAY. A hollow masonry unit composed of burned clay, shale, fire clay or mixture thereof, and having parallel cells.

WALL. A vertical element with a horizontal length-to-thickness ratio greater than three, used to enclose space.

Cavity wall. A wall built of masonry units or of concrete, or a combination of these materials, arranged to provide an airspace within the wall, and in which the inner and outer parts of the wall are tied together with metal ties.

Composite wall. A wall built of a combination of two or more masonry units bonded together, one forming the backup and the other forming the facing elements.

Dry-stacked, surface-bonded walls. A wall built of concrete masonry units where the units are stacked dry, without mortar on the bed or head joints, and where both sides of the wall are coated with a surface-bonding mortar.

Masonry-bonded hollow wall. A wall built of masonry units so arranged as to provide an airspace within the wall, and in which the facing and backing of the wall are bonded together with masonry units.

Parapet wall. The part of any wall entirely above the roof line.

WEB. An interior solid portion of a hollow masonry unit as placed in masonry.

WYTHE. Each continuous, vertical section of a wall, one masonry unit in thickness.

NOTATIONS.

A_n = Net cross-sectional area of masonry, square inches (mm^2).

b = Effective width of rectangular member or width of flange for T and I sections, inches (mm).

d_b = Diameter of reinforcement, inches (mm).

F_s = Allowable tensile or compressive stress in reinforcement, psi (MPa).

f_r = Modulus of rupture, psi (MPa).

f_y = Specified yield stress of the reinforcement or the anchor bolt, psi (MPa).

f'_{AAC} = Specified compressive strength of AAC masonry, the minimum compressive strength for a class of AAC masonry as specified in ASTM C 1386, psi (MPa).

f'_m = Specified compressive strength of masonry at age of 28 days, psi (MPa).

f'_{mi} = Specified compressive strength of masonry at the time of prestress transfer, psi (MPa).

K = The lesser of the masonry cover, clear spacing between adjacent reinforcement, or five times d_b, inches (mm).

L_s = Distance between supports, inches (mm).

L_w = Length of wall, inches (mm).

l_d = Required development length or lap length of reinforcement, inches (mm).

l_{de} = Embedment length of reinforcement, inches (mm).

P_w = Weight of wall tributary to section under consideration, pounds (N).

t = Specified wall thickness dimension or the least lateral dimension of a column, inches (mm).

V_n = Nominal shear strength, pounds (N).

V_u = Required shear strength due to factored loads, pounds (N).

W = Wind load, or related internal moments in forces.

γ = Reinforcement size factor.

ρ_n = Ratio of distributed shear reinforcement on plane perpendicular to plane of A_{mv}.

ρ_{max} = Maximum reinforcement ratio.

ϕ = Strength reduction factor.

SECTION 2103
MASONRY CONSTRUCTION MATERIALS

2103.1 Concrete masonry units. Concrete masonry units shall conform to the following standards: ASTM C 55 for concrete brick; ASTM C 73 for calcium silicate face brick; ASTM C 90 for load-bearing concrete masonry units or ASTM C 744 for prefaced concrete and calcium silicate masonry units.

2103.2 Clay or shale masonry units. Clay or shale masonry units shall conform to the following standards: ASTM C 34 for structural clay load-bearing wall tile; ASTM C 56 for structural clay nonload-bearing wall tile; ASTM C 62 for building brick (solid masonry units made from clay or shale); ASTM C 1088 for solid units of thin veneer brick; ASTM C 126 for ceramic-glazed structural clay facing tile, facing brick and solid masonry units; ASTM C 212 for structural clay facing

tile; ASTM C 216 for facing brick (solid masonry units made from clay or shale); ASTM C 652 for hollow brick (hollow masonry units made from clay or shale); and ASTM C 1405 for glazed brick (single-fired solid brick units).

Exception: Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E 119 and shall comply with the requirements of Table 602.

2103.3 AAC masonry. AAC masonry units shall conform to ASTM C 1386 for the strength class specified.

2103.4 Stone masonry units. Stone masonry units shall conform to the following standards: ASTM C 503 for marble building stone (exterior); ASTM C 568 for limestone building stone; ASTM C 615 for granite building stone; ASTM C 616 for sandstone building stone; or ASTM C 629 for slate building stone.

2103.5 Ceramic tile. Ceramic tile shall be as defined in, and shall conform to the requirements of, ANSI A137.1.

2103.6 Glass unit masonry. Hollow glass units shall be partially evacuated and have a minimum average glass face thickness of $^3/_{16}$ inch (4.8 mm). Solid glass-block units shall be provided when required. The surfaces of units intended to be in contact with mortar shall be treated with a polyvinyl butyral coating or latex-based paint. Reclaimed units shall not be used.

2103.7 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

2103.8 Mortar. Mortar for use in masonry construction shall conform to ASTM C 270 and shall conform to the proportion specifications of Table 2103.8(1) or the property specifications of Table 2103.8(2). Type S or N mortar shall be used for glass unit masonry. The amount of water used in mortar for glass unit masonry shall be adjusted to account for the lack of absorption. Retempering of mortar for glass unit masonry shall not be permitted after initial set. Unused mortar shall be discarded within $2^1/_2$ hours after initial mixing, except that unused mortar for glass unit masonry shall be discarded within $1^1/_2$ hours after initial mixing.

2103.9 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C 887. Surface bonding of concrete masonry units shall comply with ASTM C 946.

2103.10 Mortars for ceramic wall and floor tile. Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103.10.

TABLE 2103.10
CERAMIC TILE MORTAR COMPOSITIONS

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; $^1/_5$ hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; $^1/_2$ hydrated lime; 5 damp sand to 1 cement 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; $^1/_{10}$ hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; $^1/_2$ hydrated lime; $2^1/_2$ dry sand or 3 damp sand

2103.10.1 Dry-set portland cement mortars. Premixed prepared portland cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set portland cement mortar shall be installed in accordance with ANSI A108.5.

2103.10.2 Latex-modified portland cement mortar. Latex-modified portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified portland cement shall be installed in accordance with ANSI A108.5.

2103.10.3 Epoxy mortar. Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2103.10.4 Furan mortar and grout. Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2103.10.5 Modified epoxy-emulsion mortar and grout. Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

2103.10.6 Organic adhesives. Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall not be less than 40 psi (275 kPa) for Type I adhesive and not less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2103.10.7 Portland cement grouts. Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

2103.11 Mortar for AAC masonry. Thin-bed mortar for AAC masonry shall comply with Section 2103.11.1. Mortar for lev-

TABLE 2103.8(1)
MORTAR PROPORTIONS

MORTAR	TYPE	PROPORTIONS BY VOLUME (cementitious materials)								AGGREGATE MEASURED IN A DAMP, LOOSE CONDITION
		Portland cement[a] or blended cement[b]	Masonry cement[c]			Mortar cement[d]			HYDRATED LIME[e] OR LIME PUTTY	
			M	S	N	M	S	N		
Cement-lime	M	1	—	—	—	—	—	—	$\frac{1}{4}$	Not less than $2\frac{1}{4}$ and not more than 3 times the sum of the separate volumes of cementitious materials
	S	1	—	—	—	—	—	—	over $\frac{1}{4}$ to $\frac{1}{2}$	
	N	1	—	—	—	—	—	—	over $\frac{1}{2}$ to $1\frac{1}{4}$	
	O	1	—	—	—	—	—	—	over $1\frac{1}{4}$ to $2\frac{1}{2}$	
Mortar cement	M	1	—	—	—	—	—	1	—	
	M	—	—	—	—	1	—	—	—	
	S	$\frac{1}{2}$	—	—	—	—	—	1	—	
	S	—	—	—	—	—	1	—	—	
	N	—	—	—	—	—	—	1	—	
	O	—	—	—	—	—	—	1	—	
Masonry cement	M	1	—	—	1	—	—	—	—	
	M	—	1	—	—	—	—	—	—	
	S	$\frac{1}{2}$	—	—	1	—	—	—	—	
	S	—	—	1	—	—	—	—	—	
	N	—	—	—	1	—	—	—	—	
	O	—	—	—	1	—	—	—	—	

a. Portland cement conforming to the requirements of ASTM C 150.
b. Blended cement conforming to the requirements of ASTM C 595.
c. Masonry cement conforming to the requirements of ASTM C 91.
d. Mortar cement conforming to the requirements of ASTM C 1329.
e. Hydrated lime conforming to the requirements of ASTM C 207.

TABLE 2103.8(2)
MORTAR PROPERTIES[a]

MORTAR	TYPE	AVERAGE COMPRESSIVE[b] STRENGTH AT 28 DAYS minimum (psi)	WATER RETENTION minimum (%)	AIR CONTENT maximum (%)
Cement-lime	M	2,500	75	12
	S	1,800	75	12
	N	750	75	14[c]
	O	350	75	14[c]
Mortar cement	M	2,500	75	12
	S	1,800	75	12
	N	750	75	14[c]
	O	350	75	14[c]
Masonry cement	M	2,500	75	18
	S	1,800	75	18
	N	750	75	20[d]
	O	350	75	20[d]

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa.
a. This aggregate ratio (measured in damp, loose condition) shall not be less than $2\frac{1}{4}$ and not more than 3 times the sum of the separate volumes of cementitious materials.
b. Average of three 2-inch cubes of laboratory-prepared mortar, in accordance with ASTM C 270.
c. When structural reinforcement is incorporated in cement-lime or mortar cement mortars, the maximum air content shall not exceed 12 percent.
d. When structural reinforcement is incorporated in masonry cement mortar, the maximum air content shall not exceed 18 percent.

eling courses of AAC masonry shall comply with Section 2103.11.2.

2103.11.1 Thin-bed mortar for AAC masonry. Thin-bed mortar for AAC masonry shall be specifically manufactured for use with AAC masonry. Testing to verify mortar properties shall be conducted by the thin-bed mortar manufacturer and confirmed by an independent testing agency:

1. The compressive strength of thin-bed mortar, as determined by ASTM C 109, shall meet or exceed the strength of the AAC masonry units.
2. The shear strength of thin-bed mortar shall meet or exceed the shear strength of the AAC masonry units for wall assemblages tested in accordance with ASTM E 519.
3. The flexural tensile strength of thin-bed mortar shall not be less than the modulus of rupture of the masonry units. Flexural strength shall be determined by testing in accordance with ASTM E 72 (transverse load test), ASTM E 518 Method A (flexural bond strength test) or ASTM C 1072 (flexural bond strength test).
   3.1. For conducting flexural strength tests in accordance with ASTM E 518, at least five test specimens shall be constructed as stack-bonded prisms at least 32 inches (810 mm) high. The type of mortar specified by the AAC unit manufacturer shall be used.
   3.2. For flexural strength tests in accordance with ASTM C 1072, test specimens shall be constructed as stack-bonded prisms comprised with at least three bed joints. A total of at least five joints shall be tested using the type of mortar specified by the AAC unit manufacturer.
4. The splitting tensile strength of AAC masonry assemblages composed of two AAC masonry units bonded with one thin-bed mortar joint shall be determined in accordance with ASTM C 1006 and shall equal or exceed $2.4\sqrt{f'_{AAC}}$.

2103.11.2 Mortar for leveling courses of AAC masonry. Mortar used for the leveling courses of AAC masonry shall conform to Section 2103.8 and shall be Type M or S.

2103.12 Grout. Grout shall conform to Table 2103.12 or to ASTM C 476. When grout conforms to ASTM C 476, the grout shall be specified by proportion requirements or property requirements.

TABLE 2103.12
GROUT PROPORTIONS BY VOLUME FOR MASONRY CONSTRUCTION

TYPE	PARTS BY VOLUME OF PORTLAND CEMENT OR BLENDED CEMENT	PARTS BY VOLUME OF HYDRATED LIME OR LIME PUTTY	AGGREGATE, MEASURED IN A DAMP, LOOSE CONDITION	
			Fine	Coarse
Fine grout	1	0-1/10	2 1/4-3 times the sum of the volumes of the cementitious materials	—
Coarse grout	1	0-1/10	2 1/4-3 times the sum of the volumes of the cementitious materials	1-2 times the sum of the volumes of the cementitious materials

2103.13 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Sections 2103.13.1 through 2103.13.8.

2103.13.1 Deformed reinforcing bars. Deformed reinforcing bars shall conform to one of the following standards: ASTM A 615 for deformed and plain billet-steel bars for concrete reinforcement; ASTM A 706 for low-alloy steel deformed bars for concrete reinforcement; ASTM A 767 for zinc-coated reinforcing steel bars; ASTM A 775 for epoxy-coated reinforcing steel bars; and ASTM A 996 for rail and axle steel-deformed bars for concrete reinforcement.

2103.13.2 Joint reinforcement. Joint reinforcement shall comply with ASTM A 951. The maximum spacing of crosswires in ladder-type joint reinforcement and point of connection of cross wires to longitudinal wires of truss-type reinforcement shall be 16 inches (400 mm).

2103.13.3 Deformed reinforcing wire. Deformed reinforcing wire shall conform to ASTM A 496.

2103.13.4 Wire fabric. Wire fabric shall conform to ASTM A 185 for plain steel-welded wire fabric for concrete reinforcement or ASTM A 497 for welded deformed steel wire fabric for concrete reinforcement.

2103.13.5 Anchors, ties and accessories. Anchors, ties and accessories shall conform to the following standards: ASTM A 36 for structural steel; ASTM A 82 for plain steel wire for concrete reinforcement; ASTM A 185 for plain steel-welded wire fabric for concrete reinforcement; ASTM A 240 for chromium and chromium-nickel stainless steel plate, sheet and strip; ASTM A 307 Grade A for anchor bolts; ASTM A 480 for flat rolled stainless and heat-resisting steel plate, sheet and strip; and ASTM A 1008 for cold-rolled carbon steel sheet.

2103.13.6 Prestressing tendons. Prestressing tendons shall conform to one of the following standards:

1. Wire . . . . . ASTM A 421
2. Low-relaxation wire . . . . . ASTM A 421
3. Strand . . . . . ASTM A 416
4. Low-relaxation strand . . . . . ASTM A 416

5. Bar . . . . . ASTM A 722

Exceptions:

1. Wire, strands and bars not specifically listed in ASTM A 421, ASTM A 416 or ASTM A 722 are permitted, provided they conform to the minimum requirements in ASTM A 421, ASTM A 416 or ASTM A 722 and are approved by the architect/engineer.
2. Bars and wires of less than 150 kips per square inch (ksi) (1034 MPa) tensile strength and conforming to ASTM A 82, ASTM A 510, ASTM A 615, ASTM A 996 or ASTM A 706 are permitted to be used as prestressed tendons, provided that:
   2.1. The stress relaxation properties have been assessed by tests according to ASTM E 328 for the maximum permissible stress in the tendon.
   2.2. Other nonstress-related requirements of ACI 530/ASCE 5/TMS 402, Chapter 4, addressing prestressing tendons are met.

2103.13.7 Corrosion protection. Corrosion protection for prestressing tendons shall comply with the requirements of ACI 530.1/ASCE 6/TMS 602, Article 2.4G. Corrosion protection for prestressing anchorages, couplers and end blocks shall comply with the requirements of ACI 530.1/ASCE 6/TMS 602, Article 2.4H. Corrosion protection for carbon steel accessories used in exterior wall construction or interior walls exposed to a mean relative humidity exceeding 75 percent shall comply with either Section 2103.13.7.2 or 2103.13.7.3. Corrosion protection for carbon steel accessories used in interior walls exposed to a mean relative humidity equal to or less than 75 percent shall comply with either Section 2103.13.7.1, 2103.13.7.2 or 2103.13.7.3.

2103.13.7.1 Mill galvanized. Mill galvanized coatings shall be applied as follows:

1. For joint reinforcement, wall ties, anchors and inserts, a minimum coating of 0.1 ounce per square foot (31 g/m^2) complying with the requirements of ASTM A 641 shall be applied.
2. For sheet metal ties and sheet metal anchors, a minimum coating complying with Coating Designation G-60 according to the requirements of ASTM A 653 shall be applied.
3. For anchor bolts, steel plates or bars not exposed to the earth, weather or a mean relative humidity exceeding 75 percent, a coating is not required.

2103.13.7.2 Hot-dipped galvanized. Hot-dipped galvanized coatings shall be applied after fabrication as follows:

1. For joint reinforcement, wall ties, anchors and inserts, a minimum coating of 1.5 ounces per square foot (458 g/m^2) complying with the requirements of ASTM A 153, Class B shall be applied.
2. For sheet metal ties and anchors, the requirements of ASTM A 153, Class B shall be met.
3. For steel plates and bars, the requirements of either ASTM A 123 or ASTM A 153, Class B shall be met.

2103.13.7.3 Epoxy coatings. Carbon steel accessories shall be epoxy coated as follows:

1. For joint reinforcement, the requirements of ASTM A 884, Class A, Type 1 having a minimum thickness of 7 mils (175 μm) shall be met.
2. For wire ties and anchors, the requirements of ASTM A 899, Class C having a minimum thickness of 20 mils (508 μm) shall be met.
3. For sheet metal ties and anchors, a minimum thickness of 20 mils (508 μm) per surface shall be provided or a minimum thickness in accordance with the manufacturer's specification shall be provided.

2103.13.8 Tests. Where unidentified reinforcement is approved for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work.

SECTION 2104
CONSTRUCTION

2104.1 Masonry construction. Masonry construction shall comply with the requirements of Sections 2104.1.1 through 2104.5 and with ACI 530.1/ASCE 6/TMS 602.

2104.1.1 Tolerances. Masonry, except masonry veneer, shall be constructed within the tolerances specified in ACI 530.1/ASCE 6/TMS 602.

2104.1.2 Placing mortar and units. Placement of mortar and clay and concrete units shall comply with Sections 2104.1.2.1, 2104.1.2.2, 2104.1.2.3 and 2104.1.2.5. Placement of mortar and glass unit masonry shall comply with Sections 2104.1.2.4 and 2104.1.2.5. Placement of thin-bed mortar and AAC masonry shall comply with Section 2104.1.2.6.

2104.1.2.1 Bed and head joints. Unless otherwise required or indicated on the construction documents, head and bed joints shall be $^3/_8$ inch (9.5 mm) thick, except that the thickness of the bed joint of the starting course placed over foundations shall not be less than $^1/_4$ inch (6.4 mm) and not more than $^3/_4$ inch (19.1 mm).

2104.1.2.1.1 Open-end units. Open-end units with beveled ends shall be fully grouted. Head joints of open-end units with beveled ends need not be mortared. The beveled ends shall form a grout key that permits grouts within $^5/_8$ inch (15.9 mm) of the face of the unit. The units shall be tightly butted to prevent leakage of the grout.

2104.1.2.2 Hollow units. Hollow units shall be placed such that face shells of bed joints are fully mortared. Webs shall be fully mortared in all courses of piers, columns, pilasters, in the starting course on foundations

where adjacent cells or cavities are to be grouted, and where otherwise required. Head joints shall be mortared a minimum distance from each face equal to the face shell thickness of the unit.

2104.1.2.3 Solid units. Unless otherwise required or indicated on the construction documents, solid units shall be placed in fully mortared bed and head joints. The ends of the units shall be completely buttered. Head joints shall not be filled by slushing with mortar. Head joints shall be constructed by shoving mortar tight against the adjoining unit. Bed joints shall not be furrowed deep enough to produce voids.

2104.1.2.4 Glass unit masonry. Glass units shall be placed so head and bed joints are filled solidly. Mortar shall not be furrowed.

Unless otherwise required, head and bed joints of glass unit masonry shall be $^1/_4$ inch (6.4 mm) thick, except that vertical joint thickness of radial panels shall not be less than $^1/_8$ inch (3.2 mm). The bed joint thickness tolerance shall be minus $^1/_{16}$ inch (1.6 mm) and plus $^1/_8$ inch (3.2 mm). The head joint thickness tolerance shall be plus or minus $^1/_8$ inch (3.2 mm).

2104.1.2.5 Placement in mortar. Units shall be placed while the mortar is soft and plastic. Any unit disturbed to the extent that the initial bond is broken after initial positioning shall be removed and relaid in fresh mortar.

2104.1.2.6 Thin-bed mortar and AAC masonry units. AAC masonry construction shall begin with a leveling course of masonry meeting the requirements of Section 2104.1.2. Subsequent courses of AAC masonry units shall be laid with thin-bed mortar using a special notched trowel manufactured for use with thin-bed mortar to spread the mortar so that it completely fills the bed joints. Unless otherwise specified, the head joints shall be similarly filled. Joints in AAC masonry shall be approximately $^1/_{16}$ inch (1.5 mm) and shall be formed by striking on the ends and tops of AAC masonry units with a rubber mallet. Minor adjustments in unit position shall be made while the mortar is still soft and plastic by tapping it into the proper position. Minor sanding of the exposed faces of AAC masonry shall be permitted to provide a smooth and plumb surface.

2104.1.2.7 Grouted masonry. Between grout pours, a horizontal construction joint shall be formed by stopping all wythes at the same elevation and with the grout stopping a minimum of $1^1/_2$ inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be stopped a minimum of $^1/_2$ inch (12.7 mm) below the top of the masonry.

2104.1.3 Installation of wall ties. The ends of wall ties shall be embedded in mortar joints. Wall tie ends shall engage outer face shells of hollow units by at least $^1/_2$ inch (12.7 mm). Wire wall ties shall be embedded at least $1^1/_2$ inches (38 mm) into the mortar bed of solid masonry units or solid-grouted hollow units. Wall ties shall not be bent after being embedded in grout or mortar.

2104.1.4 Chases and recesses. Chases and recesses shall be constructed as masonry units are laid. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on lintels.

2104.1.5 Lintels. The design for lintels shall be in accordance with the masonry design provisions of either Section 2107 or 2108. Minimum length of end support shall be 4 inches (102 mm).

2104.1.6 Support on wood. Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304.12.

2104.1.7 Masonry protection. The top of unfinished masonry work shall be covered to protect the masonry from the weather.

2104.1.8 Weep holes. Weep holes provided in the outside wythe of masonry walls shall be at a maximum spacing of 33 inches (838 mm) on center (o.c.). Weep holes shall not be less than $^3/_{16}$ inch (4.8 mm) in diameter.

2104.1.9 Bracing of masonry. Bracing that will ensure stability of masonry during construction shall be provided and installed. Bracing shall be in accordance with the *Standard Practice for Bracing Masonry Walls Under Construction*.

Exceptions:

1. Bracing shall not be required for the unsupported wall heights specified in the *Standard Practice for Bracing Masonry Walls Under Construction*, Appendix A, when an evacuation system complying with the *Standard Practice for Bracing Masonry Walls Under Construction with Commentary* is provided.
2. Walls 8 feet (2438 mm) and less in height above grade shall not require bracing.

2104.2 Corbeled masonry. Except for corbels designed per Section 2107 or 2108, the following shall apply:

1. Corbels shall be constructed of solid masonry units.
2. The maximum corbeled projection beyond the face of the wall shall not exceed:
   - 2.1. One-half of the wall thickness for multiwythe walls bonded by mortar or grout and wall ties or masonry headers or
   - 2.2. One-half the wythe thickness for single wythe walls, masonry bonded hollow walls, multiwythe walls with open collar joints and veneer walls.
3. The maximum projection of one unit shall not exceed:
   - 3.1. One-half the nominal unit height of the unit or
   - 3.2. One-third the nominal thickness of the unit or wythe.
4. The back surface of the corbelled section shall remain within 1 inch (25 mm) of plane.

2104.2.1 Molded cornices. Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle one-third of the supporting wall. Terra cotta and metal cornices shall be provided with a

structural frame of approved noncombustible material anchored in an approved manner.

2104.3 Cold weather construction. The cold weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 C, or the following procedures shall be implemented when either the ambient temperature falls below 40°F (4°C) or the temperature of masonry units is below 40°F (4°C).

2104.3.1 Preparation.

1. Temperatures of masonry units shall not be less than 20°F (-7°C) when laid in the masonry. Masonry units containing frozen moisture, visible ice or snow on their surface shall not be laid.
2. Visible ice and snow shall be removed from the top surface of existing foundations and masonry to receive new construction. These surfaces shall be heated to above freezing, using methods that do not result in damage.

2104.3.2 Construction. The following requirements shall apply to work in progress and shall be based on ambient temperature.

2104.3.2.1 Construction requirements for temperatures between 40°F (4°C) and 32°F (0°C). The following construction requirements shall be met when the ambient temperature is between 40°F (4°C) and 32°F (0°C):

1. Glass unit masonry shall not be laid.
2. Water and aggregates used in mortar and grout shall not be heated above 140°F (60°C).
3. Mortar sand or mixing water shall be heated to produce mortar temperatures between 40°F (4°C) and 120°F (49°C) at the time of mixing. When water and aggregates for grout are below 32°F(0°C), they shall be heated.

2104.3.2.2 Construction requirements for temperatures between 32°F (0°C) and 25°F (-4°C). The requirements of Section 2104.3.2.1 and the following construction requirements shall be met when the ambient temperature is between 32°F (0°C) and 25°F (-4°C):

1. The mortar temperature shall be maintained above freezing until used in masonry.
2. Aggregates and mixing water for grout shall be heated to produce grout temperature between 70°F (21°C) and 120°F (49°C) at the time of mixing. Grout temperature shall be maintained above 70°F (21°C) at the time of grout placement.
3. Heat AAC masonry units to a minimum temperature of 40°F (4°C) before installing thin-bed mortar.

2104.3.2.3 Construction requirements for temperatures between 25°F (-4°C) and 20°F (-7°C). The requirements of Sections 2104.3.2.1 and 2104.3.2.2 and the following construction requirements shall be met when the ambient temperature is between 25°F (-4°C) and 20°F (-7°C):

1. Masonry surfaces under construction shall be heated to 40°F (4°C).
2. Wind breaks or enclosures shall be provided when the wind velocity exceeds 15 miles per hour (mph) (24 km/h).
3. Prior to grouting, masonry shall be heated to a minimum of 40°F (4°C).

2104.3.2.4 Construction requirements for temperatures below 20°F (-7°C). The requirements of Sections 2104.3.2.1, 2104.3.2.2 and 2104.3.2.3 and the following construction requirement shall be met when the ambient temperature is below 20°F (-7°C): Enclosures and auxiliary heat shall be provided to maintain air temperature within the enclosure to above 32°F (0°C).

2104.3.3 Protection. The requirements of this section and Sections 2104.3.3.1 through 2104.3.3.5 apply after the masonry is placed and shall be based on anticipated minimum daily temperature for grouted masonry and anticipated mean daily temperature for ungrouted masonry.

2104.3.3.1 Glass unit masonry. The temperature of glass unit masonry shall be maintained above 40°F (4°C) for 48 hours after construction.

2104.3.3.2 AAC masonry. The temperature of AAC masonry shall be maintained above 32°F (0°C) for the first 4 hours after thin-bed mortar application.

2104.3.3.3 Protection requirements for temperatures between 40°F (4°C) and 25°F (-4°C). When the temperature is between 40°F (4°C) and 25°F (-4°C), newly constructed masonry shall be covered with a weather-resistive membrane for 24 hours after being completed.

2104.3.3.4 Protection requirements for temperatures between 25°F (-4°C) and 20°F (-7°C). When the temperature is between 25°F (-4°C) and 20°F (-7°C), newly constructed masonry shall be completely covered with weather-resistive insulating blankets, or equal protection, for 24 hours after being completed. The time period shall be extended to 48 hours for grouted masonry, unless the only cement in the grout is Type III portland cement.

2104.3.3.5 Protection requirements for temperatures below 20°F (-7°C). When the temperature is below 20°F (-7°C), newly constructed masonry shall be maintained at a temperature above 32°F (0°C) for at least 24 hours after being completed by using heated enclosures, electric heating blankets, infrared lamps or other acceptable methods. The time period shall be extended to 48 hours for grouted masonry, unless the only cement in the grout is Type III portland cement.

2104.4 Hot weather construction. The hot weather construction provisions of ACI 530.1/ASCE 6/TMS 602, Article 1.8 D, or the following procedures shall be implemented when the temperature or the temperature and wind-velocity limits of this section are exceeded.

2104.4.1 Preparation. The following requirements shall be met prior to conducting masonry work.

2104.4.1.1 Temperature. When the ambient temperature exceeds 100°F (38°C), or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (3.5 m/s):

1. Necessary conditions and equipment shall be provided to produce mortar having a temperature below 120°F (49°C).
2. Sand piles shall be maintained in a damp, loose condition.

2104.4.1.2 Special conditions. When the ambient temperature exceeds 115°F (46°C), or 105°F (40°C) with a wind velocity greater than 8 mph (3.5 m/s), the requirements of Section 2104.4.1.1 shall be implemented, and materials and mixing equipment shall be shaded from direct sunlight.

2104.4.2 Construction. The following requirements shall be met while masonry work is in progress.

2104.4.2.1 Temperature. When the ambient temperature exceeds 100°F (38°C), or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (3.5 m/s):

1. The temperature of mortar and grout shall be maintained below 120°F (49°C).
2. Mixers, mortar transport containers and mortar boards shall be flushed with cool water before they come into contact with mortar ingredients or mortar.
3. Mortar consistency shall be maintained by retempering with cool water.
4. Mortar shall be used within 2 hours of initial mixing.
5. Thin-bed mortar shall be spread no more than 4 feet (1219 mm) ahead of AAC masonry units.
6. AAC masonry units shall be placed within one minute after spreading thin-bed mortar.

2104.4.2.2 Special conditions. When the ambient temperature exceeds 115°F (46°C), or exceeds 105°F (40°C) with a wind velocity greater than 8 mph (3.5 m/s), the requirements of Section 2104.4.2.1 shall be implemented and cool mixing water shall be used for mortar and grout. The use of ice shall be permitted in the mixing water prior to use. Ice shall not be permitted in the mixing water when added to the other mortar or grout materials.

2104.4.3 Protection. When the mean daily temperature exceeds 100°F (38°C) or exceeds 90°F (32°C) with a wind velocity greater than 8 mph (3.5 m/s), newly constructed masonry shall be fog sprayed until damp at least three times a day until the masonry is three days old.

2104.5 Wetting of brick. Brick (clay or shale) at the time of laying shall require wetting if the unit's initial rate of water absorption exceeds 30 grams per 30 square inches (19 355 mm^2) per minute or 0.035 ounce per square inch (1 g/645 mm^2) per minute, as determined by ASTM C 67.

SECTION 2105
QUALITY ASSURANCE

2105.1 General. A quality assurance program shall be used to ensure that the constructed masonry is in compliance with the construction documents.

2105.2 Acceptance relative to strength requirements.

2105.2.1 Compliance with f'_m and f'_{AAC}. Compressive strength of masonry shall be considered satisfactory if the compressive strength of each masonry wythe and grouted collar joint equals or exceeds the value of f'_m for clay and concrete masonry and f'_{AAC} for AAC masonry. For partially grouted clay and concrete masonry, the compressive strength of both the grouted and ungrouted masonry shall equal or exceed the applicable f'_m. At the time of prestress, the compressive strength of the masonry shall equal or exceed f'_{mi}, which shall be less than or equal to f'_m.

2105.2.2 Determination of compressive strength. The compressive strength for each wythe shall be determined by the unit strength method or by the prism test method as specified herein.

2105.2.2.1 Unit strength method.

2105.2.2.1.1 Clay masonry. The compressive strength of masonry shall be determined based on the strength of the units and the type of mortar specified using Table 2105.2.2.1.1, provided:

1. Units conform to ASTM C 62, ASTM C 216 or ASTM C 652 and are sampled and tested in accordance with ASTM C 67.
2. Thickness of bed joints does not exceed $^5/_8$ inch (15.9 mm).
3. For grouted masonry, the grout meets one of the following requirements:
   3.1. Grout conforms to ASTM C 476.
   3.2. Minimum grout compressive strength equals or exceeds f'_m but not less than 2,000 psi (13.79 MPa). The compressive strength of grout shall be determined in accordance with ASTM C 1019.

TABLE 2105.2.2.1.1
COMPRESSIVE STRENGTH OF CLAY MASONRY

NET AREA COMPRESSIVE STRENGTH OF CLAY MASONRY UNITS (psi)		NET AREA COMPRESSIVE STRENGTH OF MASONRY (psi)
Type M or S mortar	Type N mortar	
1,700	2,100	1,000
3,350	4,150	1,500
4,950	6,200	2,000
6,600	8,250	2,500
8,250	10,300	3,000
9,900	—	3,500
13,200	—	4,000

For SI: 1 pound per square inch = 0.00689 MPa.

2105.2.2.1.2 Concrete masonry. The compressive strength of masonry shall be determined based on the

strength of the unit and type of mortar specified using Table 2105.2.2.1.2, provided:

1. Units conform to ASTM C 55 or ASTM C 90 and are sampled and tested in accordance with ASTM C 140.
2. Thickness of bed joints does not exceed $^5/_8$ inch (15.9 mm).
3. For grouted masonry, the grout meets one of the following requirements:
   3.1. Grout conforms to ASTM C 476.
   3.2. Minimum grout compressive strength equals or exceeds f'_m but not less than 2,000 psi (13.79 MPa). The compressive strength of grout shall be determined in accordance with ASTM C 1019.

TABLE 2105.2.2.1.2
COMPRESSIVE STRENGTH OF CONCRETE MASONRY

NET AREA COMPRESSIVE STRENGTH OF CONCRETE MASONRY UNITS (psi)		NET AREA COMPRESSIVE STRENGTH OF MASONRY (psi)[a]
Type M or S mortar	Type N mortar	
1,250	1,300	1,000
1,900	2,150	1,500
2,800	3,050	2,000
3,750	4,050	2,500
4,800	5,250	3,000

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.
a. For units less than 4 inches in height, 85 percent of the values listed.

2105.2.2.1.3 AAC masonry. The compressive strength of AAC masonry shall be based on the strength of the AAC masonry unit only and the following shall be met:

1. Units conform to ASTM C 1386.
2. Thickness of bed joints does not exceed $^1/_8$ inch (3.2 mm).
3. For grouted masonry, the grout meets one of the following requirements:
   3.1. Grout conforms to ASTM C 476.
   3.2. Minimum grout compressive strength equals or exceeds f'_{AAC} but not less than 2,000 psi (13.79 MPa). The compressive strength of grout shall be determined in accordance with ASTM C 1019.

2105.2.2.2 Prism test method.

2105.2.2.2.1 General. The compressive strength of clay and concrete masonry shall be determined by the prism test method:

1. Where specified in the construction documents.
2. Where masonry does not meet the requirements for application of the unit strength method in Section 2105.2.2.1.

2105.2.2.2.2 Number of prisms per test. A prism test shall consist of three prisms constructed and tested in accordance with ASTM C 1314.

2105.3 Testing prisms from constructed masonry. When approved by the building official, acceptance of masonry that does not meet the requirements of Section 2105.2.2.1 or 2105.2.2.2 shall be permitted to be based on tests of prisms cut from the masonry construction in accordance with Sections 2105.3.1, 2105.3.2 and 2105.3.3.

2105.3.1 Prism sampling and removal. A set of three masonry prisms that are at least 28 days old shall be saw cut from the masonry for each 5,000 square feet (465 m^2) of the wall area that is in question but not less than one set of three masonry prisms for the project. The length, width and height dimensions of the prisms shall comply with the requirements of ASTM C 1314. Transporting, preparation and testing of prisms shall be in accordance with ASTM C 1314.

2105.3.2 Compressive strength calculations. The compressive strength of prisms shall be the value calculated in accordance ASTM C 1314, except that the net cross-sectional area of the prism shall be based on the net mortar bedded area.

2105.3.3 Compliance. Compliance with the requirement for the specified compressive strength of masonry, f'_m, shall be considered satisfied provided the modified compressive strength equals or exceeds the specified f'_m. Additional testing of specimens cut from locations in question shall be permitted.

SECTION 2106
SEISMIC DESIGN
RESERVED

SECTION 2107
ALLOWABLE STRESS DESIGN

2107.1 General. The design of masonry structures using allowable stress design shall comply with the requirements of Chapters 1 and 2 of ACI 530/ASCE 5/TMS 402 except as modified by Section 2107.2. Lap splices shall be in accordance with ACI 530/ASCE 5/TMS 402 or in accordance with Section 2107.3 or 2107.5 as specified by the architect or engineer. Development of bars in tension and compression shall be in accordance with ACI 530/ASCE 5/TMS 402 or in accordance with 2107.4 as specified by the architect or engineer.

Exception: Where inspections are performed by a local building department in accordance with Section 105, the provisions of ACI 530/ASCE 5/TMS 402, Chapter 1, Section 1-15 and ACI 530.1/ASCE 6/TMS 602. Section 1.6 shall not apply unless specified by the architect or engineer.

2107.2 ACI 530/ASCE 5/TMS 402, Section 2.1.6, columns. Add the following text to Section 2.1.6:

2.1.6.6 Light-frame construction. Masonry columns used only to support light-frame roofs of carports, porches, sheds or similar structures with a maximum area of 450 square

feet (41.8 m^2) are permitted to be designed and constructed as follows:

1. Concrete masonry materials shall be in accordance with Section 2103.1 of the *Florida Building Code, Building*. Clay or shale masonry units shall be in accordance with Section 2103.2 of the *Florida Building Code, Building*.
2. The nominal cross-sectional dimension of columns shall not be less than 8 inches (203 mm).
3. Columns shall be reinforced with not less than one No. 4 bar centered in each cell of the column.
4. Columns shall be grouted solid.
5. Columns shall not exceed 12 feet (3658 mm) in height.
6. Roofs shall be anchored to the columns. Such anchorage shall be capable of resisting the design loads specified in Chapter 16 of the *Florida Building Code, Building*.
7. Where such columns are required to resist uplift loads, the columns shall be anchored to their footings with two No. 4 bars extending a minimum of 24 inches (610 mm) into the columns and bent horizontally a minimum of 15 inches (381 mm) in opposite directions into the footings. One of these bars is permitted to be the reinforcing bar specified in Item 3 above. The total weight of a column and its footing shall not be less than 1.5 times the design uplift load.

2107.3 ACI 530/ASCE 5/TMS 402, Section 2.1.10.7.1.1, lap splices. Modify Section 2.1.10.7.1.1 as follows:

2.1.10.7.1.1 The minimum length of lap splices for reinforcing bars in tension or compression, l_d, shall be

$l_d = 0.002 d_b f_s$ **(Equation 21-2)**

For SI: $l_d = 0.29 d_b f_s$

but not less than 12 inches (305 mm). In no case shall the length of the lapped splice be less than 40 bar diameters.

where:

d_b = Diameter of reinforcement, inches (mm).

f_s = Computed stress in reinforcement due to design loads, psi (MPa).

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of the allowable steel tension stress, F_s, the lap length of splices shall be increased not less than 50 percent of the minimum required length. Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted.

Where epoxy coated bars are used, lap length shall be increased by 50 percent.

2107.4 ACI 530/ASCE 5/TMS 402, Section 2.1.10.3, Development of bars in tension and compression. Modify Section 2.1.10.3 as follows:

2.1.10.3 The required development length of reinforcing bars shall be determined by Equation (2-9), but shall not be less than 12 inches (305 mm), but need not be greater than 72 d_b.

Equation 2-9 from ACI 530/ASCE 5/TMS 402, unchanged.

K shall not exceed the lesser of the masonry cover, clear spacing between adjacent reinforcement, nor 5 times d_b.

$\gamma = 1.0$ for No. 3 (M#10) through No. 5 (M#16) bars;

$\gamma = 1.04$ for No. 6 (M#19) through No. 7 (M#22) bars; and

$\gamma = 1.2$ for No. 8 (M#25) through No. 11 (M#36) bars

Where epoxy coated bars are used. lap length shall be increased by 50 percent.

2107.5 ACI 530/ASCE 5/TMS 402, Section 2.1.10.7, splices of reinforcement. Modify Section 2.1.10.7 as follows:

2.1.10.7 Splices of reinforcement. Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. All welding shall conform to AWS D1.4. Reinforcement larger than No. 9 (M #29) shall be spliced using mechanical connections in accordance with Section 2.1.10.7.3.

SECTION 2108
STRENGTH DESIGN OF MASONRY

2108.1 General. The design of masonry structures using strength design shall comply with the requirements of Chapters 1 and 3 of ACI 530/ASCE 5/TMS 402, except as modified by Sections 2108.2 and 2108.3.

Exceptions:

1. AAC masonry shall comply with the requirements of Chapter 1 and Appendix A of ACI 530/ASCE 5/TMS 402.
2. Where inspections are performed by a local building department in accordance with Section 105, the provisions of ACI 530/ASCE 5/TMS 402, Chapter 1, Section 1-15 and ACI 530.1/ASCE 6/TMS 602, Section 1.6 shall not apply unless specified by the architect or engineer.

2108.2 ACI 530/ASCE 5/TMS 402, Section 3.3.3.3. Modify Section 3.3.3.3 as follows:

3.3.3.3 Development - The required development length of reinforcement shall be determined by Equation (3-15), but shall not be less than 12 inches (305 mm) and need not be greater than 72 d_b.

Equation 3-15 from ACI 530/ASCE 5/TMS 402, unchanged

K shall not exceed the lesser of the masonry cover, clear spacing between adjacent reinforcement, nor 5 times d_b.

$\gamma = 1.0$ for No. 3 (M#10) through No. 5 (M#16) bars;

$\gamma = 1.04$ for No. 6 (M#19) through No. 7 (M#22) bars; and

$\gamma = 1.2$ for No. 8 (M#25) through No. 11 (M#36) bars

Where epoxy coated bars are used. lap length shall be increased by 50 percent.

2108.3 ACI 530/ASCE 5/TMS 402, Section 3.3.3.5, maximum areas of flexural tensile reinforcement. Add the following text to Section 3.3.3.5:

3.3.3.5.5 For special prestressed masonry shear walls, strain in all prestressing steel shall be computed to be compatible with a strain in the extreme tension reinforcement equal to five times the strain associated with the reinforcement yield stress, f_y. The calculation of the maximum reinforcement shall consider forces in the prestressing steel that correspond to these calculated strains.

SECTION 2109
EMPIRICAL DESIGN OF MASONRY

2109.1 General. Empirically designed masonry shall conform to this chapter or Chapter 5 of ACI 530/ASCE 5/TMS 402.

2109.1.1 Limitations. The use of empirical design of masonry shall be limited as follows:

1. Empirical design shall not be used for masonry elements that are part of the lateral-force-resisting system where the basic wind speed exceeds 100 mph (45 m/s).
2. Empirical design shall not be used for interior masonry elements that are not part of the lateral force-resisting system in buildings other than enclosed buildings as defined in Chapter 6 of ASCE 7 in:
   - 2.1. Buildings over 180 feet (55 100 mm) in height.
   - 2.2. Buildings over 60 feet (18 400 mm) in height where the basic wind speed exceeds 90 mph (40 m/s).
   - 2.3. Buildings over 35 feet (10 700 mm) in height where the basic wind speed exceeds 100 mph (45 m/s).
   - 2.4. Where the basic wind speed exceeds 100 mph (45 m/s).
3. Empirical design shall not be used for exterior masonry elements that are not part of the lateral force-resisting system and that are more than 35 feet (10 700 mm) above ground:
   - 3.1. Buildings over 180 feet (55 100 mm) in height.
   - 3.2. Buildings over 60 feet (18 400 mm) in height where the basic wind speed exceeds 90 mph (40 m/s).
   - 3.3. Buildings over 35 feet (10 700 mm) in height where the basic wind speed exceeds 100 mph (45 m/s).
4. Empirical design shall not be used for exterior masonry elements that are less than or equal to 35 feet (10 700 mm) above ground where the basic wind speed exceeds 100 mph (45 m/s).
5. Empirical design shall be used only when the resultant of gravity loads is within the center third of the wall thickness and within the central area bounded by lines at one-third of each cross-sectional dimension of foundation piers.
6. Empirical design shall not be used for AAC masonry.

In buildings that exceed one or more of the above limitations, masonry shall be designed in accordance with the engineered design provisions of Section 2107 or 2108 or the foundation wall provisions of Section 1805.5.

2109.2 Lateral stability.

2109.2.1 Shear walls. Where the structure depends upon masonry walls for lateral stability, shear walls shall be provided parallel to the direction of the lateral forces resisted.

2109.2.1.1 Cumulative length of shear walls. In each direction in which shear walls are required for lateral stability, shear walls shall be positioned in two separate planes. The minimum cumulative length of shear walls provided shall be 0.4 times the long dimension of the building. Cumulative length of shear walls shall not include openings or any element with a length that is less than one-half its height.

2109.2.1.2 Maximum diaphragm ratio. Masonry shear walls shall be spaced so that the length-to-width ratio of each diaphragm transferring lateral forces to the shear walls does not exceed the values given in Table 2109.2.1.2.

TABLE 2109.2.1.2
DIAPHRAGM LENGTH-TO-WIDTH RATIOS

FLOOR OR ROOF DIAPHRAGM CONSTRUCTION	MAXIMUM LENGTH-TO-WIDTH RATIO OF DIAPHRAGM PANEL
Cast-in-place concrete	5:1
Precast concrete	4:1
Metal deck with concrete fill	3:1
Metal deck with no fill	2:1
Wood	2:1

2109.2.2 Roofs. The roof construction shall be designed so as not to impart out-of-plane lateral thrust to the walls under roof gravity load.

2109.2.3 Surface-bonded walls. Dry-stacked, surface-bonded concrete masonry walls shall comply with the requirements of this code for masonry wall construction, except where otherwise noted in this section.

2109.2.3.1 Strength. Dry-stacked, surface-bonded concrete masonry walls shall be of adequate strength and proportions to support all superimposed loads without exceeding the allowable stresses listed in Table 2109.2.3.1. Allowable stresses not specified in Table 2109.2.3.1 shall comply with the requirements of ACI 530/ASCE 5/TMS 402.

TABLE 2109.2.3.1
ALLOWABLE STRESS GROSS CROSS-SECTIONAL AREA FOR DRY-STACKED, SURFACE-BONDED CONCRETE MASONRY WALLS

DESCRIPTION	MAXIMUM ALLOWABLE STRESS (psi)
Compression standard block	45
Flexural tension Horizontal span Vertical span	 30 18
Shear	10

For SI: 1 pound per square inch = 0.006895 MPa.

2109.2.3.2 Construction. Construction of dry-stacked, surface-bonded masonry walls, including stacking and leveling of units, mixing and application of mortar and curing and protection shall comply with ASTM C 946.

2109.3 Compressive stress requirements.

2109.3.1 Calculations. Compressive stresses in masonry due to vertical dead plus live loads, excluding wind loads, shall be determined in accordance with Section 2109.3.2.1. Dead and live loads shall be in accordance with Chapter 16, with live load reductions as permitted in Section 1607.9.

2109.3.2 Allowable compressive stresses. The compressive stresses in masonry shall not exceed the values given in Table 2109.3.2. Stress shall be calculated based on specified rather than nominal dimensions.

2109.3.2.1 Calculated compressive stresses. Calculated compressive stresses for single wythe walls and for multiwythe composite masonry walls shall be determined by dividing the design load by the gross cross-sectional area of the member. The area of openings, chases or recesses in walls shall not be included in the gross cross-sectional area of the wall.

2109.3.2.2 Multiwythe walls. The allowable stress shall be as given in Table 2109.3.2 for the weakest combination of the units used in each wythe.

2109.4 Lateral support.

2109.4.1 Intervals. Masonry walls shall be laterally supported in either the horizontal or vertical direction at intervals not exceeding those given in Table 2109.4.1.

TABLE 2109.4.1
WALL LATERAL SUPPORT REQUIREMENTS

CONSTRUCTION	MAXIMUM WALL LENGTH TO THICKNESS OR WALL HEIGHT TO THICKNESS
Bearing walls	
Solid units or fully grouted	20
All others	18
Nonbearing walls	
Exterior	18
Interior	36

2109.4.2 Thickness. Except for cavity walls and cantilever walls, the thickness of a wall shall be its nominal thickness measured perpendicular to the face of the wall. For cavity walls, the thickness shall be determined as the sum of the nominal thicknesses of the individual wythes. For cantilever walls, except for parapets, the ratio of height-to-nominal thickness shall not exceed 6 for solid masonry or 4 for hollow masonry. For parapets, see Section 2109.5.4.

2109.4.3 Support elements. Lateral support shall be provided by cross walls, pilasters, buttresses or structural frame members when the limiting distance is taken horizontally, or by floors, roofs acting as diaphragms or structural frame members when the limiting distance is taken vertically.

2109.5 Thickness of masonry. Minimum thickness requirements shall be based on nominal dimensions of masonry.

2109.5.1 Thickness of walls. The thickness of masonry walls shall conform to the requirements of Section 2109.5.

2109.5.2 Minimum thickness.

2109.5.2.1 Bearing walls. The minimum thickness of masonry bearing walls more than one story high shall be 8 inches (203 mm). Bearing walls of one-story buildings shall not be less than 6 inches (152 mm) thick.

2109.5.2.2 Rubble stone walls. The minimum thickness of rough, random or coursed rubble stone walls shall be 16 inches (406 mm).

2109.5.2.3 Shear walls. The minimum thickness of masonry shear walls shall be 8 inches (203 mm).

2109.5.2.4 Foundation walls. The minimum thickness of foundation walls shall be 8 inches (203 mm) and as required by Section 2109.5.3.1.

2109.5.2.5 Foundation piers. The minimum thickness of foundation piers shall be 8 inches (203 mm).

2109.5.2.6 Parapet walls. The minimum thickness of parapet walls shall be 8 inches (203 mm) and as required by Section 2109.5.4.1.

2109.5.2.7 Change in thickness. Where walls of masonry of hollow units or masonry bonded hollow walls are decreased in thickness, a course or courses of solid masonry shall be interposed between the wall below and the thinner wall above, or special units or construction shall be used to transmit the loads from face shells or wythes above to those below.

2109.5.3 Foundation walls. Foundation walls shall comply with the requirements of Section 2109.5.3.1 or 2109.5.3.2.

2109.5.3.1 Minimum thickness. Minimum thickness for foundation walls shall comply with the requirements of Table 2109.5.3.1. The provisions of Table 2109.5.3.1 are only applicable where the following conditions are met:

1. The foundation wall does not exceed 8 feet (2438 mm) in height between lateral supports;
2. The terrain surrounding foundation walls is graded to drain surface water away from foundation walls;
3. Backfill is drained to remove ground water away from foundation walls;
4. Lateral support is provided at the top of foundation walls prior to backfilling;
5. The length of foundation walls between perpendicular masonry walls or pilasters is a maximum of three times the basement wall height;
6. The backfill is granular and soil conditions in the area are nonexpansive; and
7. Masonry is laid in running bond using Type M or S mortar.

TABLE 2109.3.2
ALLOWABLE COMPRESSIVE STRESSES FOR EMPIRICAL DESIGN OF MASONRY

CONSTRUCTION; COMPRESSIVE STRENGTH OF UNIT GROSS AREA (psi)	ALLOWABLE COMPRESSIVE STRESSES[a] GROSS CROSS-SECTIONAL AREA (psi)	
	Type M or S mortar	Type N mortar
Solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:		
8,000 or greater	350	300
4,500	225	200
2,500	160	140
1,500	115	100
Grouted masonry, of clay or shale; sand-lime or concrete:		
4,500 or greater	225	200
2,500	160	140
1,500	115	100
Solid masonry of solid concrete masonry units:		
3,000 or greater	225	200
2,000	160	140
1,200	115	100
Masonry of hollow load-bearing units:		
2,000 or greater	140	120
1,500	115	100
1,000	75	70
700	60	55
Hollow walls (noncomposite masonry bonded)[b]		
Solid units:		
2,500 or greater	160	140
1,500	115	100
Hollow units	75	70
Stone ashlar masonry:		
Granite	720	640
Limestone or marble	450	400
Sandstone or cast stone	360	320
Rubble stone masonry		
Coursed, rough or random	120	100

For SI: 1 pound per square inch = 0.006895 MPa.

a. Linear interpolation for determining allowable stresses for masonry units having compressive strengths which are intermediate between those given in the table is permitted.

b. Where floor and roof loads are carried upon one wythe, the gross cross-sectional area is that of the wythe under load; if both wythes are loaded, the gross cross-sectional area is that of the wall minus the area of the cavity between the wythes. Walls bonded with metal ties shall be considered as noncomposite walls unless collar joints are filled with mortar or grout.

TABLE 2109.5.3.1
FOUNDATION WALL CONSTRUCTION

WALL CONSTRUCTION	NOMINAL WALL THICKNESS (inches)	MAXIMUM DEPTH OF UNBALANCED BACKFILL (feet)
Fully grouted masonry	8	7
	10	8
	12	8
Hollow unit masonry	8	5
	10	6
	12	7
Solid unit masonry	8	5
	10	7
	12	7

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

2109.5.3.2 Design requirements. Where the requirements of Section 2109.5.3.1 are not met, foundation walls shall be designed in accordance with Section 1805.5.

2109.5.4 Parapet walls.

2109.5.4.1 Minimum thickness. The minimum thickness of unreinforced masonry parapets shall meet Section 2109.5.2.6 and their height shall not exceed three times their thickness.

2109.5.4.2 Additional provisions. Additional provisions for parapet walls are contained in Sections 1503.2 and 1503.3.

2109.6 Bond.

2109.6.1 General. The facing and backing of multiwythe masonry walls shall be bonded in accordance with Section 2109.6.2, 2109.6.3 or 2109.6.4.

2109.6.2 Bonding with masonry headers.

2109.6.2.1 Solid units. Where the facing and backing (adjacent wythes) of solid masonry construction are bonded by means of masonry headers, no less than 4 percent of the wall surface of each face shall be composed of headers extending not less than 3 inches (76 mm) into the backing. The distance between adjacent full-length headers shall not exceed 24 inches (610 mm) either vertically or horizontally. In walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap at least 3 inches (76 mm), or headers from opposite sides shall be covered with another header course overlapping the header below at least 3 inches (76 mm).

2109.6.2.2 Hollow units. Where two or more hollow units are used to make up the thickness of a wall, the stretcher courses shall be bonded at vertical intervals not exceeding 34 inches (864 mm) by lapping at least 3 inches (76 mm) over the unit below, or by lapping at vertical intervals not exceeding 17 inches (432 mm) with units that are at least 50 percent greater in thickness than the units below.

2109.6.2.3 Masonry bonded hollow walls. In masonry bonded hollow walls, the facing and backing shall be bonded so that not less than 4 percent of the wall surface of each face is composed of masonry bonded units extending not less than 3 inches (76 mm) into the backing. The distance between adjacent bonders shall not exceed 24 inches (610 mm) either vertically or horizontally.

2109.6.3 Bonding with wall ties or joint reinforcement.

2109.6.3.1 Bonding with wall ties. Except as required by Section 2109.6.3.1.1, where the facing and backing (adjacent wythes) of masonry walls are bonded with wire size W2.8 (MW18) wall ties or metal wire of equivalent stiffness embedded in the horizontal mortar joints, there shall be at least one metal tie for each $4^1/_2$ square feet (0.42 m^2) of wall area. The maximum vertical distance between ties shall not exceed 24 inches (610 mm), and the maximum horizontal distance shall not exceed 36 inches (914 mm). Rods or ties bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical. In other walls, the ends of ties shall be bent to 90-degree (1.57 rad) angles to provide hooks no less than 2 inches (51 mm) long. Wall ties shall be without drips. Additional bonding ties shall be provided at all openings, spaced not more than 36 inches (914 mm) apart around the perimeter and within 12 inches (305 mm) of the opening.

2109.6.3.1.1 Bonding with adjustable wall ties. Where the facing and backing (adjacent wythes) of masonry are bonded with adjustable wall ties, there shall be at least one tie for each 1.77 square feet (0.164 m^2) of wall area. Neither the vertical nor horizontal spacing of the adjustable wall ties shall exceed 16 inches (406 mm). The maximum vertical offset of bed joints from one wythe to the other shall be $1^1/_4$ inches (32 mm). The maximum clearance between connecting parts of the ties shall be $^1/_{16}$ inch (1.6 mm). When pintle legs are used, ties shall have at least two wire size W2.8 (MW18) legs.

2109.6.3.2 Bonding with prefabricated joint reinforcement. Where the facing and backing (adjacent wythes) of masonry are bonded with prefabricated joint reinforcement, there shall be at least one cross wire serving as a tie for each $2^2/_3$ square feet (0.25 m^2) of wall area. The vertical spacing of the joint reinforcing shall not exceed 24 inches (610 mm). Cross wires on prefabricated joint reinforcement shall not be less than W1.7 (MW11) and shall be without drips. The longitudinal wires shall be embedded in the mortar.

2109.6.4 Bonding with natural or cast stone.

2109.6.4.1 Ashlar masonry. In ashlar masonry, bonder units, uniformly distributed, shall be provided to the extent of not less than 10 percent of the wall area. Such bonder units shall extend not less than 4 inches (102 mm) into the backing wall.

2109.6.4.2 Rubble stone masonry. Rubble stone masonry 24 inches (610 mm) or less in thickness shall have bonder units with a maximum spacing of 36 inches (914 mm) vertically and 36 inches (914 mm) horizontally, and if the masonry is of greater thickness than 24 inches (610 mm), shall have one bonder unit for each 6 square feet (0.56 m^2) of wall surface on both sides.

2109.6.5 Masonry bonding pattern.

2109.6.5.1 Masonry laid in running bond. Each wythe of masonry shall be laid in running bond, head joints in successive courses shall be offset by not less than one-fourth the unit length or the masonry walls shall be reinforced longitudinally as required in Section 2109.6.5.2.

2109.6.5.2 Masonry laid in stack bond. Where unit masonry is laid with less head joint offset than in Section 2109.6.5.1, the minimum area of horizontal reinforcement placed in mortar bed joints or in bond beams spaced not more than 48 inches (1219 mm) apart, shall be 0.0003 times the vertical cross-sectional area of the wall.

2109.7 Anchorage.

2109.7.1 General. Masonry elements shall be anchored in accordance with Sections 2109.7.2 through 2109.7.4.

2109.7.2 Intersecting walls. Masonry walls depending upon one another for lateral support shall be anchored or bonded at locations where they meet or intersect by one of the methods indicated in Sections 2109.7.2.1 through 2109.7.2.5.

2109.7.2.1 Bonding pattern. Fifty percent of the units at the intersection shall be laid in an overlapping masonry bonding pattern, with alternate units having a bearing of not less than 3 inches (76 mm) on the unit below.

2109.7.2.2 Steel connectors. Walls shall be anchored by steel connectors having a minimum section of $^1/_4$ inch (6.4 mm) by $1^1/_2$ inches (38 mm), with ends bent up at least 2 inches (51 mm) or with cross pins to form anchorage. Such anchors shall be at least 24 inches (610 mm) long and the maximum spacing shall be 48 inches (1219 mm).

2109.7.2.3 Joint reinforcement. Walls shall be anchored by joint reinforcement spaced at a maximum distance of 8 inches (203 mm). Longitudinal wires of such reinforcement shall be at least wire size W1.7 (MW 11) and shall extend at least 30 inches (762 mm) in each direction at the intersection.

2109.7.2.4 Interior nonload-bearing walls. Interior nonload-bearing walls shall be anchored at their intersection, at vertical intervals of not more than 16 inches (406 mm) with joint reinforcement or $^1/_4$-inch (6.4 mm) mesh galvanized hardware cloth.

2109.7.2.5 Ties, joint reinforcement or anchors. Other metal ties, joint reinforcement or anchors, if used, shall be spaced to provide equivalent area of anchorage to that required by this section.

2109.7.3 Floor and roof anchorage. Floor and roof diaphragms providing lateral support to masonry shall comply with the live loads in Section 1607.3 and shall be connected to the masonry in accordance with Sections 2109.7.3.1 through 2109.7.3.3. Roof loading shall be determined in accordance with Chapter 16 and, when net uplift occurs, uplift shall be resisted entirely by an anchorage system designed in accordance with the provisions of Sections 2.1 and 2.3, Sections 3.1 and 3.3 or Chapter 4 of ACI 530/ASCE 5/TMS 402.

2109.7.3.1 Wood floor joists. Wood floor joists bearing on masonry walls shall be anchored to the wall at intervals not to exceed 72 inches (1829 mm) by metal strap anchors. Joists parallel to the wall shall be anchored with metal straps spaced not more than 72 inches (1829 mm) o.c. extending over or under and secured to at least three joists. Blocking shall be provided between joists at each strap anchor.

2109.7.3.2 Steel floor joists. Steel floor joists bearing on masonry walls shall be anchored to the wall with $^3/_8$-inch (9.5 mm) round bars, or their equivalent, spaced not more than 72 inches (1829 mm) o.c. Where joists are parallel to the wall, anchors shall be located at joist bridging.

2109.7.3.3 Roof diaphragms. Roof diaphragms shall be anchored to masonry walls with $^1/_2$-inch-diameter (12.7 mm) bolts, 72 inches (1829 mm) o.c. or their equivalent. Bolts shall extend and be embedded at least 15 inches (381 mm) into the masonry, or be hooked or welded to not less than 0.20 square inch (129 mm^2) of bond beam reinforcement placed not less than 6 inches (152 mm) from the top of the wall.

2109.7.4 Walls adjoining structural framing. Where walls are dependent upon the structural frame for lateral support, they shall be anchored to the structural members with metal anchors or otherwise keyed to the structural members. Metal anchors shall consist of $^1/_2$-inch (12.7 mm) bolts spaced at 48 inches (1219 mm) o.c. embedded 4 inches (102 mm) into the masonry, or their equivalent area.

2109.8 Adobe construction. Adobe construction shall comply with this section and shall be subject to the requirements of this code for Type V construction.

2109.8.1 Unstabilized adobe.

2109.8.1.1 Compressive strength. Adobe units shall have an average compressive strength of 300 psi (2068 kPa) when tested in accordance with ASTM C 67. Five samples shall be tested and no individual unit is permitted to have a compressive strength of less than 250 psi (1724 kPa).

2109.8.1.2 Modulus of rupture. Adobe units shall have an average modulus of rupture of 50 psi (345 kPa) when tested in accordance with the following procedure. Five samples shall be tested and no individual unit shall have a modulus of rupture of less than 35 psi (241 kPa).

2109.8.1.2.1 Support conditions. A cured unit shall be simply supported by 2-inch-diameter (51 mm) cylindrical supports located 2 inches (51 mm) in from each end and extending the full width of the unit.

2109.8.1.2.2 Loading conditions. A 2-inch-diameter (51 mm) cylinder shall be placed at midspan parallel to the supports.

2109.8.1.2.3 Testing procedure. A vertical load shall be applied to the cylinder at the rate of 500 pounds per minute (37 N/s) until failure occurs.

2109.8.1.2.4 Modulus of rupture determination. The modulus of rupture shall be determined by the equation:

$$f_r = 3WL_s/2bt^2 \qquad \textbf{(Equation 21-4)}$$

where, for the purposes of this section only:

b = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

f_r = Modulus of rupture, psi (MPa).

L_s = Distance between supports, inches (mm).

t = Thickness of the test specimen measured parallel to the direction of load, inches (mm).

W = The applied load at failure, pounds (N).

2109.8.1.3 Moisture content requirements. Adobe units shall have a moisture content not exceeding 4 percent by weight.

2109.8.1.4 Shrinkage cracks. Adobe units shall not contain more than three shrinkage cracks and any single shrinkage crack shall not exceed 3 inches (76 mm) in length or $^1/_8$ inch (3.2 mm) in width.

2109.8.2 Stabilized adobe.

2109.8.2.1 Material requirements. Stabilized adobe shall comply with the material requirements of unstabilized adobe in addition to Sections 2109.8.2.1.1 and 2109.8.2.1.2.

2109.8.2.1.1 Soil requirements. Soil used for stabilized adobe units shall be chemically compatible with the stabilizing material.

2109.8.2.1.2 Absorption requirements. A 4-inch (102 mm) cube, cut from a stabilized adobe unit dried to a constant weight in a ventilated oven at 212°F to 239°F (100°C to 115°C), shall not absorb more than $2^1/_2$ percent moisture by weight when placed upon a constantly water-saturated, porous surface for seven days. A minimum of five specimens shall be tested and each specimen shall be cut from a separate unit.

2109.8.3 Allowable stress. The allowable compressive stress based on gross cross-sectional area of adobe shall not exceed 30 psi (207 kPa).

2109.8.3.1 Bolts. Bolt values shall not exceed those set forth in Table 2109.8.3.1.

TABLE 2109.8.3.1
ALLOWABLE SHEAR ON BOLTS IN ADOBE MASONRY

DIAMETER OF BOLTS (inches)	MINIMUM EMBEDMENT (inches)	SHEAR (pounds)
$^1/_2$	—	—
$^5/_8$	12	200
$^3/_4$	15	300
$^7/_8$	18	400
1	21	500
$1^1/_8$	24	600

For SI: 1 inch = 25.4 mm, 1 pound = 4.448 N.

2109.8.4 Construction.

2109.8.4.1 General.

2109.8.4.1.1 Height restrictions. Adobe construction shall be limited to buildings not exceeding one story, except that two-story construction is allowed when designed by a registered design professional.

2109.8.4.1.2 Mortar restrictions. Mortar for stabilized adobe units shall comply with Chapter 21 or adobe soil. Adobe soil used as mortar shall comply with material requirements for stabilized adobe. Mortar for unstabilized adobe shall be portland cement mortar.

2109.8.4.1.3 Mortar joints. Adobe units shall be laid with full head and bed joints and in full running bond.

2109.8.4.1.4 Parapet walls. Parapet walls constructed of adobe units shall be waterproofed.

2109.8.4.2 Wall thickness. The minimum thickness of exterior walls in one-story buildings shall be 10 inches (254 mm). The walls shall be laterally supported at intervals not exceeding 24 feet (7315 mm). The minimum thickness of interior load-bearing walls shall be 8 inches (203 mm). In no case shall the unsupported height of any wall constructed of adobe units exceed 10 times the thickness of such wall.

2109.8.4.3 Foundations.

2109.8.4.3.1 Foundation support. Walls and partitions constructed of adobe units shall be supported by foundations or footings that extend not less than 6 inches (152 mm) above adjacent ground surfaces and are constructed of solid masonry (excluding adobe) or concrete. Footings and foundations shall comply with Chapter 18.

2109.8.4.3.2 Lower course requirements. Stabilized adobe units shall be used in adobe walls for the first 4 inches (102 mm) above the finished first-floor elevation.

2109.8.4.4 Isolated piers or columns. Adobe units shall not be used for isolated piers or columns in a load-bearing capacity. Walls less than 24 inches (610 mm) in length shall be considered isolated piers or columns.

2109.8.4.5 Tie beams. Exterior walls and interior load-bearing walls constructed of adobe units shall have a continuous tie beam at the level of the floor or roof bearing and meeting the following requirements.

2109.8.4.5.1 Concrete tie beams. Concrete tie beams shall be a minimum depth of 6 inches (152 mm) and a minimum width of 10 inches (254 mm). Concrete tie beams shall be continuously reinforced with a minimum of two No. 4 reinforcing bars. The ultimate compressive strength of concrete shall be at least 2,500 psi (17.2 MPa) at 28 days.

2109.8.4.5.2 Wood tie beams. Wood tie beams shall be solid or built up of lumber having a minimum nominal thickness of 1 inch (25 mm), and shall have a minimum depth of 6 inches (152 mm) and a minimum

width of 10 inches (254 mm). Joints in wood tie beams shall be spliced a minimum of 6 inches (152 mm). No splices shall be allowed within 12 inches (305 mm) of an opening. Wood used in tie beams shall be approved naturally decay-resistant or pressure-treated wood.

2109.8.4.6 Exterior finish. Exterior walls constructed of unstabilized adobe units shall have their exterior surface covered with a minimum of two coats of portland cement plaster having a minimum thickness of $^3/_4$ inch (19.1 mm) and conforming to ASTM C 926. Lathing shall comply with ASTM C 1063. Fasteners shall be spaced at 16 inches (406 mm) o.c. maximum. Exposed wood surfaces shall be treated with an approved wood preservative or other protective coating prior to lath application.

2109.8.4.7 Lintels. Lintels shall be considered structural members and shall be designed in accordance with the applicable provisions of Chapter 16.

SECTION 2110
GLASS UNIT MASONRY

2110.1 Scope. This section covers the empirical requirements for nonload-bearing glass unit masonry elements in exterior or interior walls.

2110.1.1 Limitations. Solid or hollow approved glass block shall not be used in fire walls, party walls, fire barriers or fire partitions, or for load-bearing construction. Such blocks shall be erected with mortar and reinforcement in metal channel-type frames, structural frames, masonry or concrete recesses, embedded panel anchors as provided for both exterior and interior walls or other approved joint materials. Wood strip framing shall not be used in walls required to have a fire-resistance rating by other provisions of this code.

Exceptions:

1. Glass-block assemblies having a fire protection rating of not less than $^3/_4$ hour shall be permitted as opening protectives in accordance with Section 715 in fire barriers and fire partitions that have a required fire-resistance rating of 1 hour or less and do not enclose exit stairways or exit passageways.
2. Glass-block assemblies as permitted in Section 404.5, Exception 2.
3. Fire tested and listed glass unit masonry shall be permitted for use in accordance with its listing.

2110.2 Units. Hollow or solid glass-block units shall be standard or thin units.

2110.2.1 Standard units. The specified thickness of standard units shall be at least 3 $^7/_8$ inches (98 mm).

2110.2.2 Thin units. The specified thickness of thin units shall be 3 $^1/_8$ inches (79 mm) for hollow units or 3 inches (76 mm) for solid units.

2110.3 Panel size.

2110.3.1 Exterior standard-unit panels. The maximum area of each individual exterior standard-unit panel shall be 144 square feet (13.4 m^2) when the design wind pressure is 20 psf (958 N/m^2). The maximum panel dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height. The panel areas are permitted to be adjusted in accordance with Figure 2110.3.1 for other wind pressures.

2110.3.2 Exterior thin-unit panels. The maximum area of each individual exterior thin-unit panel shall be 85 square feet (7.9 m^2). The maximum dimension between structural supports shall be 15 feet (4572 mm) in width or 10 feet (3048 mm) in height. Thin units shall not be used in applications where the design wind pressure exceeds 20 psf (958 N/m^2).

2110.3.3 Interior panels. The maximum area of each individual standard-unit panel shall be 250 square feet (23.2 m^2). The maximum area of each thin-unit panel shall be 150 square feet (13.9 m^2). The maximum dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.

2110.3.4 Solid units. The maximum area of solid glass-block wall panels in both exterior and interior walls shall not be more than 100 square feet (9.3 m^2).

2110.3.5 Curved panels. The width of curved panels shall conform to the requirements of Sections 2110.3.1, 2110.3.2 and 2110.3.3, except additional structural supports shall be provided at locations where a curved section joins a straight section, and at inflection points in multicurved walls.

2110.4 Support.

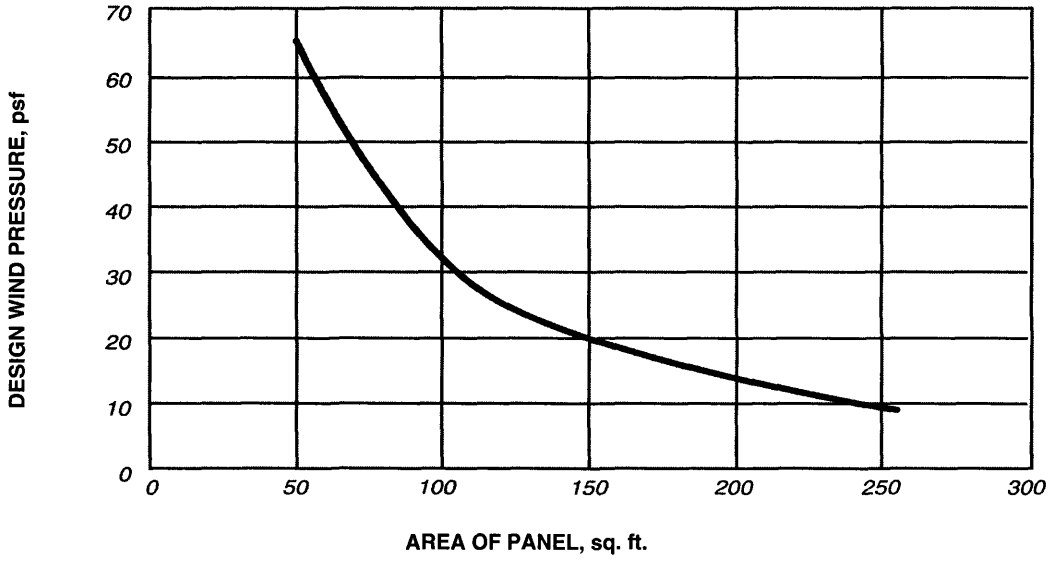
2110.4.1 General requirements. Glass unit masonry panels shall be isolated so that in-plane loads are not imparted to the panel.

2110.4.2 Vertical. Maximum total deflection of structural members supporting glass unit masonry shall not exceed $^l/_{600}$.

2110.4.2.1 Support on wood construction. Glass unit masonry having an installed weight of 40 psf (195 kg/m^2) or less and a maximum height of 12 feet (3658 mm) shall be permitted to be supported on wood construction.

2110.4.2.2 Expansion joint. A vertical expansion joint in glass unit masonry shall be provided to isolate the glass unit masonry supported by wood construction from that supported by other types of construction.

2110.4.3 Lateral. Glass unit masonry panels more than one unit wide or one unit high shall be laterally supported along their tops and sides. Lateral support shall be provided by panel anchors along the top and sides spaced not more than 16 inches (406 mm) o.c. or by channel-type restraints. Glass unit masonry panels shall be recessed at least 1 inch (25 mm) within channels and chases. Channel-type restraints shall be oversized to accommodate expansion material in the opening and packing and sealant between the framing restraints and the glass unit masonry perimeter units. Lateral supports for glass unit masonry panels shall be designed to



For SI: 1 square foot = 0.0929 m^2, 1 pound per square foot = 47.9 N/m^2.

FIGURE 2110.3.1
GLASS MASONRY DESIGN WIND LOAD RESISTANCE

resist applied loads, or a minimum of 200 pounds per lineal feet (plf) (2919 N/m) of panel, whichever is greater.

Exceptions:

1. Lateral support at the top of glass unit masonry panels that are no more than one unit wide shall not be required.
2. Lateral support at the sides of glass unit masonry panels that are no more than one unit high shall not be required.

2110.4.3.1 Single unit panels. Single unit glass unit masonry panels shall conform to the requirements of Section 2110.4.3, except lateral support shall not be provided by panel anchors.

2110.5 Expansion joints. Glass unit masonry panels shall be provided with expansion joints along the top and sides at structural supports. Expansion joints shall have sufficient thickness to accommodate displacements of the supporting structure, but shall not be less than $^3/_8$ inch (9.5 mm) in thickness. Expansion joints shall be entirely free of mortar or other debris and shall be filled with resilient material. The sills of glass-block panels shall be coated with approved water-based asphaltic emulsion, or other elastic waterproofing material, prior to laying the first mortar course.

2110.6 Mortar. Mortar for glass unit masonry shall comply with Section 2103.8.

2110.7 Reinforcement. Glass unit masonry panels shall have horizontal joint reinforcement spaced not more than 16 inches (406 mm) on center, located in the mortar bed joint, and extending the entire length of the panel but not across expansion joints. Longitudinal wires shall be lapped a minimum of 6 inches (152 mm) at splices. Joint reinforcement shall be placed in the bed joint immediately below and above openings in the panel. The reinforcement shall have not less than two parallel longitudinal wires of size W1.7 (MW11), and have welded cross wires of size W1.7 (MW11).

SECTION 2111
MASONRY FIREPLACES

2111.1 Definition. A masonry fireplace is a fireplace constructed of concrete or masonry. Masonry fireplaces shall be constructed in accordance with this section.

2111.2 Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least 6 inches (153 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

2111.2.1 Ash dump cleanout. Cleanout openings, located within foundation walls below fireboxes, when provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

2111.3 Seismic reinforcing. Reserved.

2111.4 Seismic anchorage. Reserved.

2111.5 Firebox walls. Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. When a lining of firebrick at least 2 inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and sidewalls shall each be 8 inches (203 mm) of solid masonry, including the lining. The

width of joints between firebricks shall not be greater than $^1/_4$ inch (6.4 mm). When no lining is provided, the total minimum thickness of back and sidewalls shall be 10 inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C 27 or ASTM C 1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C 199.

2111.5.1 Steel fireplace units. Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace provided they are installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than $^1/_4$ inch (6.4 mm) in thickness, and an air-circulating chamber which is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

2111.6 Firebox dimensions. The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall not be less than 8 inches (203 mm) above the fireplace opening. The throat opening shall not be less than 4 inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall not be less than the cross-sectional area of the flue.

Exception: Rumford fireplaces shall be permitted provided that the depth of the fireplace is at least 12 inches (305 mm) and at least one-third of the width of the fireplace opening, and the throat is at least 12 inches (305 mm) above the lintel, and at least $^1/_{20}$ the cross-sectional area of the fireplace opening.

2111.7 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace throat or damper shall be located a minimum of 8 inches (203 mm) above the top of the fireplace opening.

2111.7.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located at least 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

2111.8 Smoke chamber walls. Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. Corbeling of masonry units shall not leave unit cores exposed to the inside of the smoke chamber. The inside surface of corbeled masonry shall be parged smooth. Where no lining is provided, the total minimum thickness of front, back and sidewalls shall be 8 inches (203 mm) of solid masonry. When a lining of firebrick at least 2 inches (51 mm) thick, or a lining of vitrified clay at least $^5/_8$ inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be 6 inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C 27 or ASTM C 1261 and shall be laid with refractory mortar conforming to ASTM C 199.

2111.8.1 Smoke chamber dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall not be greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.76 rad) from vertical when prefabricated smoke chamber linings are used or when the smoke chamber walls are rolled or sloped rather than corbeled. When the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

2111.9 Hearth and hearth extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. No combustible material shall remain against the underside of hearths or hearth extensions after construction.

2111.9.1 Hearth thickness. The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

2111.9.2 Hearth extension thickness. The minimum thickness of hearth extensions shall be 2 inches (51 mm).

Exception: When the bottom of the firebox opening is raised at least 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than $^3/_8$-inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

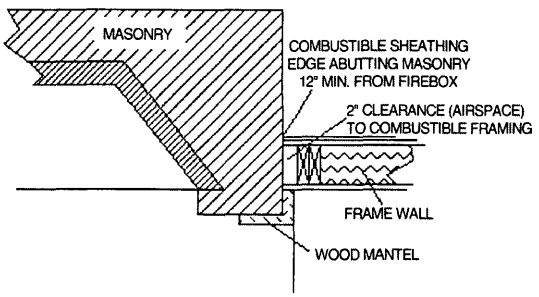
2111.10 Hearth extension dimensions. Hearth extensions shall extend at least 16 inches (406 mm) in front of, and at least 8 inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.557 m^2) or larger, the hearth extension shall extend at least 20 inches (508 mm) in front of, and at least 12 inches (305 mm) beyond, each side of the fireplace opening.

2111.11 Fireplace clearance. Any portion of a masonry fireplace located in the interior of a building or within the exterior wall of a building shall have a clearance to combustibles of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The airspace shall not be filled, except to provide fireblocking in accordance with Section 2111.12.

Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's installation instructions are permitted to have combustible material in contact with their exterior surfaces.
2. When masonry fireplaces are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.

3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, flooring and drywall, are permitted to abut the masonry fireplace sidewalls and hearth extension, in accordance with Figure 2111.11, provided such combustible trim or sheathing is a minimum of 12 inches (306 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening, provided such combustible materials shall not be placed within 6 inches (153 mm) of a fireplace opening. Combustible material directly above and within 12 inches (305 mm) of the fireplace opening shall not project more than $^1/_8$ inch (3.2 mm) for each 1-inch (25 mm) distance from such opening. Combustible materials located along the sides of the fireplace opening that project more than $1^1/_2$ inches (38 mm) from the face of the fireplace shall have an additional clearance equal to the projection.



For SI: 1 inch = 25.4 mm

FIGURE 2111.11
ILLUSTRATION OF EXCEPTION TO FIREPLACE CLEARANCE PROVISION

2111.12 Fireplace fireblocking. All spaces between fireplaces and floors and ceilings through which fireplaces pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be to a depth of 1 inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

2111.13 Exterior air. Factory-built or masonry fireplaces covered in this section shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

2111.13.1 Factory-built fireplaces. Exterior combustion air ducts for factory-built fireplaces shall be listed components of the fireplace, and installed according to the fireplace manufacturer's instructions.

2111.13.2 Masonry fireplaces. Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer's instructions.

2111.13.3 Exterior air intake. The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling. The exterior air intake shall not be located within the garage, attic, basement or crawl space of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of $^1/_4$-inch (6.4 mm) mesh.

2111.13.4 Clearance. Unlisted combustion air ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

2111.13.5 Passageway. The combustion air passageway shall be a minimum of 6 square inches (3870 mm^2) and not more than 55 square inches (0.035 m^2), except that combustion air systems for listed fireplaces or for fireplaces tested for emissions shall be constructed according to the fireplace manufacturer's instructions.

2111.13.6 Outlet. The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

SECTION 2112
MASONRY HEATERS

2112.1 Definition. A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as "masonry," which is designed to absorb and store heat from a solid fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox may include flow in a horizontal or downward direction before entering the chimney and which delivers heat by radiation from the masonry surface of the heater.

2112.2 Installation. Masonry heaters shall be installed in accordance with this section and comply with one of the following:

1. Masonry heaters shall comply with the requirements of ASTM E 1602; or
2. Masonry heaters shall be listed and labeled in accordance with UL 1482 and installed in accordance with the manufacturer's installation instructions.

2112.3 Footings and foundation. The firebox floor of a masonry heater shall be a minimum thickness of 4 inches (102 mm) of noncombustible material and be supported on a noncombustible footing and foundation in accordance with Section 2113.2.

2112.4 Seismic reinforcing. Reserved.

2112.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (765 mm) of the outside surface of a masonry heater in accordance with NFPA 211, Section 8-7 (clearances for solid fuel-burning appliances), and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

1. When the masonry heater wall thickness is at least 8 inches (203 mm) thick of solid masonry and the wall thickness of the heat exchange channels is at least 5 inches (127 mm) thick of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of at least 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
2. Masonry heaters listed and labeled in accordance with UL 1482 and installed in accordance with the manufacturer's instructions.

SECTION 2113
MASONRY CHIMNEYS

2113.1 Definition. A masonry chimney is a chimney constructed of concrete or masonry, hereinafter referred to as "masonry." Masonry chimneys shall be constructed, anchored, supported and reinforced as required in this chapter.

2113.2 Footings and foundations. Footings for masonry chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least 6 inches (152 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be at least 12 inches (305 mm) below finished grade.

2113.3 Seismic reinforcing. Reserved.

2113.3.1 Vertical reinforcing. Reserved.

2113.3.2 Horizontal reinforcing. Reserved.

2113.4 Seismic anchorage. Reserved.

2113.4.1 Anchorage. Reserved.

2113.5 Corbeling. Masonry chimneys shall not be corbeled more than half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls is permitted to equal the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

2113.6 Changes in dimension. The chimney wall or chimney flue lining shall not change in size or shape within 6 inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

2113.7 Offsets. Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in Section 2113.5.

2113.8 Additional load. Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys are permitted to be constructed as part of the masonry walls or concrete walls of the building.

2113.9 Termination. Chimneys shall extend at least 2 feet (610 mm) higher than any portion of the building within 10 feet (3048 mm), but shall not be less than 3 feet (914 mm) above the highest point where the chimney passes through the roof.

2113.9.1 Spark arrestors. Where a spark arrestor is installed on a masonry chimney, the spark arrestor shall meet all of the following requirements:

1. The net free area of the arrestor shall not be less than four times the net free area of the outlet of the chimney flue it serves.
2. The arrestor screen shall have heat and corrosion resistance equivalent to 19-gage galvanized steel or 24-gage stainless steel.
3. Openings shall not permit the passage of spheres having a diameter greater than $^1/_2$ inch (13 mm) nor block the passage of spheres having a diameter less than $^3/_8$ inch (11 mm).
4. The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

2113.10 Wall thickness. Masonry chimney walls shall be constructed of concrete, solid masonry units or hollow masonry units grouted solid with not less than 4 inches (102 mm) nominal thickness.

2113.10.1 Masonry veneer chimneys. Where masonry is used as veneer for a framed chimney, through flashing and weep holes shall be provided as required by Chapter 14.

2113.11 Flue lining (material). Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, according to the terms of the appliance listing and the manufacturer's instructions.

2113.11.1 Residential-type appliances (general). Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C 315, or equivalent.
2. Listed chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

2113.11.1.1 Flue linings for specific appliances. Flue linings other than those covered in Section 2113.11.1 intended for use with specific appliances shall comply with Sections 2113.11.1.2 through 2113.11.1.4 and Sections 2113.11.2 and 2113.11.3.

2113.11.1.2 Gas appliances. Flue lining systems for gas appliances shall be in accordance with the *Florida Building Code, Fuel Gas*.

2113.11.1.3 Pellet fuel-burning appliances. Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to flue lining systems complying with Section 2113.11.1 and pellet vents listed for installation within masonry chimneys (see Section 2113.11.1.5 for marking).

2113.11.1.4 Oil-fired appliances approved for use with L-vent. Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to flue lining systems complying with Section 2113.11.1 and listed chimney liners complying with UL 641 (see Section 2113.11.1.5 for marking).

2113.11.1.5 Notice of usage. When a flue is relined with a material not complying with Section 2113.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language: "This chimney is for use only with (type or category of appliance) that burns (type of fuel). Do not connect other types of appliances."

2113.11.2 Concrete and masonry chimneys for medium-heat appliances.

2113.11.2.1 General. Concrete and masonry chimneys for medium-heat appliances shall comply with Sections 2113.1 through 2113.5.

2113.11.2.2 Construction. Chimneys for medium-heat appliances shall be constructed of solid masonry units or of concrete with walls a minimum of 8 inches (203 mm) thick, or with stone masonry a minimum of 12 inches (305 mm) thick.

2113.11.2.3 Lining. Concrete and masonry chimneys shall be lined with an approved medium-duty refractory brick a minimum of $4^1/_2$ inches (114 mm) thick laid on the $4^1/_2$-inch bed (114 mm) in an approved medium-duty refractory mortar. The lining shall start 2 feet (610 mm) or more below the lowest chimney connector entrance. Chimneys terminating 25 feet (7620 mm) or less above a chimney connector entrance shall be lined to the top.

2113.11.2.4 Multiple passageway. Concrete and masonry chimneys containing more than one passageway shall have the liners separated by a minimum 4-inch-thick (102 mm) concrete or solid masonry wall.

2113.11.2.5 Termination height. Concrete and masonry chimneys for medium-heat appliances shall extend a minimum of 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm).

2113.11.2.6 Clearance. A minimum clearance of 4 inches (102 mm) shall be provided between the exterior surfaces of a concrete or masonry chimney for medium-heat appliances and combustible material.

2113.11.3 Concrete and masonry chimneys for high-heat appliances.

2113.11.3.1 General. Concrete and masonry chimneys for high-heat appliances shall comply with Sections 2113.1 through 2113.5.

2113.11.3.2 Construction. Chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or of concrete, each wall to be a minimum of 8 inches (203 mm) thick with a minimum airspace of 2 inches (51 mm) between the walls.

2113.11.3.3 Lining. The inside of the interior wall shall be lined with an approved high-duty refractory brick, a minimum of $4^1/_2$ inches (114 mm) thick laid on the $4^1/_2$-inch bed (114 mm) in an approved high-duty refractory mortar. The lining shall start at the base of the chimney and extend continuously to the top.

2113.11.3.4 Termination height. Concrete and masonry chimneys for high-heat appliances shall extend a minimum of 20 feet (6096 mm) higher than any portion of any building within 50 feet (15 240 mm).

2113.11.3.5 Clearance. Concrete and masonry chimneys for high-heat appliances shall have approved clearance from buildings and structures to prevent overheating combustible materials, permit inspection and maintenance operations on the chimney and prevent danger of burns to persons.

2113.12 Clay flue lining (installation). Clay flue liners shall be installed in accordance with ASTM C 1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope no greater than 30 degrees (0.52 rad) from the vertical.

Clay flue liners shall be laid in medium-duty refractory mortar conforming to ASTM C 199 with tight mortar joints left smooth on the inside and installed to maintain an air space or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

2113.13 Additional requirements.

2113.13.1 Listed materials. Listed materials used as flue linings shall be installed in accordance with the terms of their listings and the manufacturer's instructions.

2113.13.2 Space around lining. The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

Exception: This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's instructions.

2113.14 Multiple flues. When two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be at least 4 inches (102 mm) thick and bonded into the walls of the chimney.

Exception: When venting only one appliance, two flues are permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered at least 4 inches (102 mm).

2113.15 Flue area (appliance). Chimney flues shall not be smaller in area than the area of the connector from the appliance. Chimney flues connected to more than one appliance shall not be less than the area of the largest connector plus 50 percent of the areas of additional chimney connectors.

Exceptions:

1. Chimney flues serving oil-fired appliances sized in accordance with NFPA 31.
2. Chimney flues serving gas-fired appliances sized in accordance with the *Florida Building Code, Fuel Gas*.

2113.16 Flue area (masonry fireplace). Flue sizing for chimneys serving fireplaces shall be in accordance with Section 2113.16.1 or 2113.16.2.

2113.16.1 Minimum area. Round chimney flues shall have a minimum net cross-sectional area of at least $^1/_{12}$ of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of at least $^1/_{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum net cross-sectional area of at least $^1/_{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of at least $^1/_8$ of the fireplace opening.

2113.16.2 Determination of minimum area. The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113.16. A flue size providing at least the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are as provided in Tables 2113.16(1) and 2113.16(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the firebox floor to the top of the chimney flue.

TABLE 2113.16(1)
NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES[a]

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
10 $^3/_4$	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2.
a. Flue sizes are based on ASTM C 315.

TABLE 2113.16(2)
NET CROSS-SECTIONAL AREA OF SQUARE AND RECTANGULAR FLUE SIZES

FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	CROSS-SECTIONAL AREA (square inches)
4.5 × 8.5	23
4.5 × 13	34
8 × 8	42
8.5 × 8.5	49
8 × 12	67
8.5 × 13	76
12 × 12	102
8.5 × 18	101
13 × 13	127
12 × 16	131
13 × 18	173
16 × 16	181
16 × 20	222
18 × 18	233
20 × 20	298
20 × 24	335
24 × 24	431

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2.

2113.17 Inlet. Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

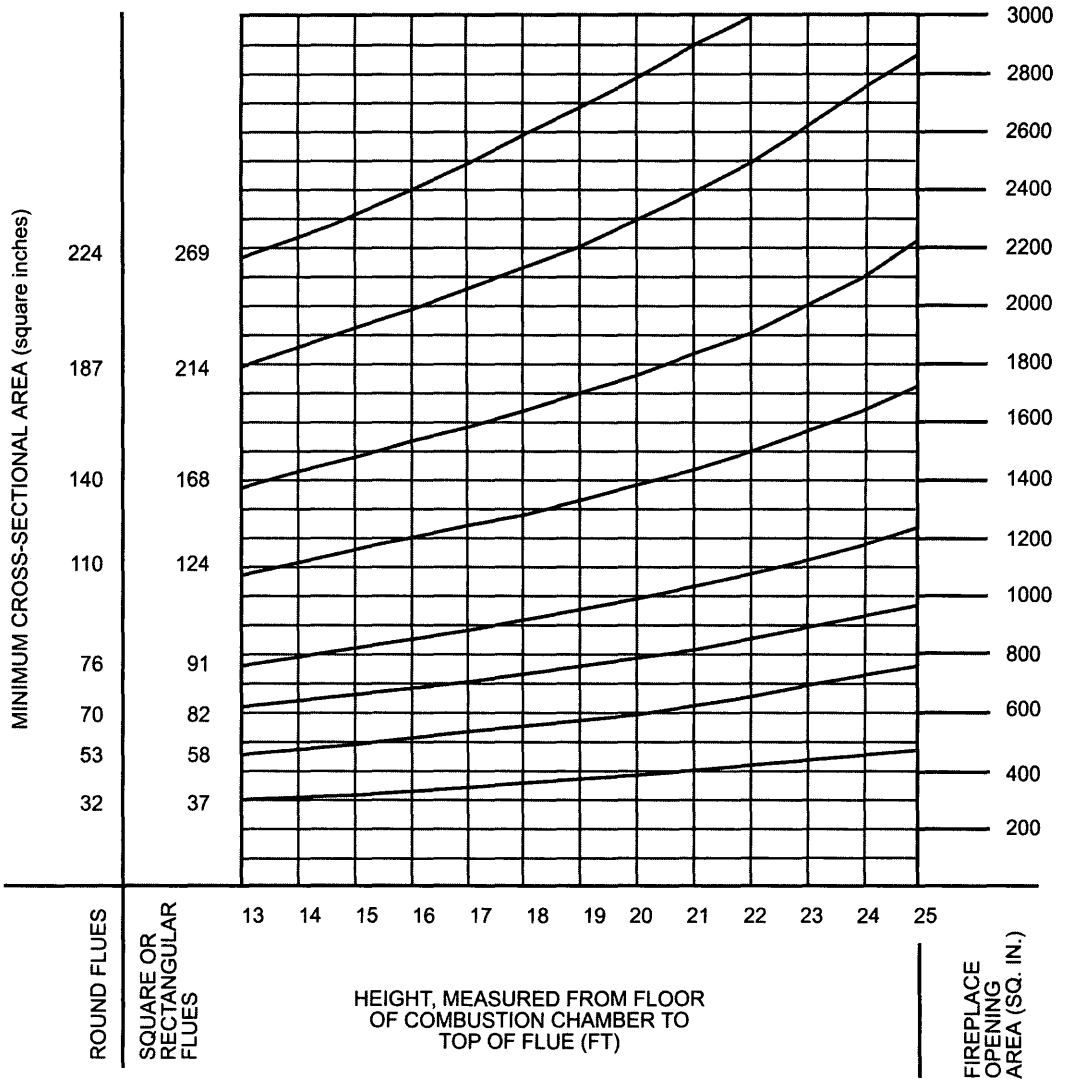
2113.18 Masonry chimney cleanout openings. Cleanout openings shall be provided within 6 inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located at least 6 inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be at least 6 inches (152 mm). The cleanout shall be provided with a noncombustible cover.

Exception: Chimney flues serving masonry fireplaces, where cleaning is possible through the fireplace opening.

2113.19 Chimney clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The airspace shall not be filled, except to provide fireblocking in accordance with Section 2113.20.

Exceptions:

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's



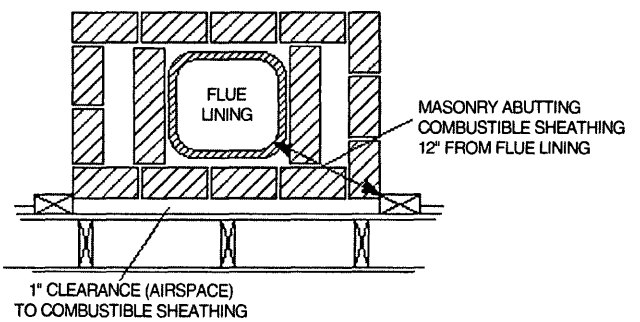
For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm^2.

FIGURE 2113.16
FLUE SIZES FOR MASONRY CHIMNEYS

instructions, are permitted to have combustible material in contact with their exterior surfaces.

2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, are permitted to abut the masonry chimney sidewalls, in accordance with Figure 2113.19, provided such combustible trim or sheathing is a minimum of 12 inches (305 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than 1 inch (25 mm).

2113.20 Chimney fireblocking. All spaces between chimneys and floors and ceilings through which chimneys pass shall be



For SI: 1 inch = 25.4 mm.

FIGURE 2113.19
ILLUSTRATION OF EXCEPTION THREE CHIMNEY CLEARANCE PROVISION

fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be to a depth of 1 inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

SECTION 2114
TERMITE INSPECTION

2114.1 Cleaning. Cells and cavities in masonry units and air gaps between brick, stone or masonry veneers and the structure shall be cleaned of all nonpreservative-treated or nonnaturally durable wood, or other cellulose-containing material prior to concrete placement.

Exception: Inorganic material manufactured for closing cells in foundation concrete masonry unit construction or clean earth fill placed in concrete masonry unit voids below slab level before termite treatment is performed.

2114.2 Concrete bearing ledge. Brick, stone or other veneer shall be supported by a concrete-bearing ledge at least equal to the total thickness of the brick, stone or other veneer, which is poured integrally with the concrete foundation. No supplemental concrete foundation pours which will create a hidden cold joint shall be used without supplemental treatment in the foundation unless there is an approved physical barrier. An approved physical barrier shall also be installed from below the wall sill plate or first block course horizontally to embed in a mortar joint. If masonry veneer extends below grade, a termite protective treatment must be applied to the cavity created between the veneer and the foundation, in lieu of a physical barrier.

Exception: Veneer supported by a shelf, angle or lintel secured to the foundation sidewall in accordance with ACI 530/ASCE 5/TMS 402, provided at least a 6-inch (152 mm) clear inspection space of the foundation sidewall exterior exist between the veneer and the top of any soil, sod, mulch or other organic landscaping component, deck, apron, porch, walk or any other work immediately adjacent to or adjoining the structure.

SECTION 2115
SPECIAL WIND PROVISIONS FOR MASONRY

2115.1 Gable endwalls.

2115.1.1 General. Gable endwalls shall be structurally continuous between points of lateral support.

2115.1.2 Cathedral endwalls. Gable endwalls adjacent to cathedral ceilings shall be structurally continuous from the uppermost floor to the ceiling diaphragm or to the roof diaphragm.

SECTIONS 2116 – 2117
RESERVED

SECTION 2118
HIGH-VELOCITY HURRICANE ZONES—DESIGN

2118.1 Masonry shall be designed by a method admitting of rational analysis based on established principles of mechanics.

SECTION 2119
HIGH-VELOCITY HURRICANE ZONES—QUALITY, TESTS, AND APPROVALS

2119.1 Quality. The quality of materials assembled into masonry and the method and manner of their assembly shall conform to the requirements of this chapter.

2119.1.1 Workmanship. Masonry construction shall be in conformance with the tolerances, quality and methods of construction as set forth in standards referenced in this chapter; the Portland Cement Association *Concrete Masonry Handbook,* ANSI A41.1, A41.2 and AWS Structural Welding Code: Reinforcing Steel (D1.4).

2119.1.2 Other materials. A material of masonry, other than set forth herein, which is incombustible and otherwise sufficiently embodies the characteristics and satisfies the requirements of one of the materials herein may be approved by the building official, subject to such tests as may be prescribed.

2119.2 Tests.

2119.2.1 The building official may require materials to be subjected to tests to determine their quality whenever there is reason to believe that a material is no longer up to the standards on which the approval was based. The cost of such tests shall be borne by the person or persons proposing to use or continue to use such material or product.

2119.2.2 Materials shall be tested in accordance with the standard specifications of the ASTM International as such standard specifications are noted in this chapter.

2119.3 Approvals.

2119.3.1 Only such masonry units as bear the approval of the building official and are manufactured or fabricated by plants having a certificate of competency issued by the authority having jurisdiction, shall be considered acceptable for the construction of buildings or other structures.

2119.3.2 Approval of masonry units and manufacturing or fabricating plants shall be for periods not to exceed one year and may be obtained upon application and the submission of certificates of tests in accordance with the provisions of this chapter.

2119.3.3 The provisions for tests for approval of masonry units shall not be construed as in lieu of any tests otherwise required under this chapter.

2119.3.4 Failure of a manufacturer of masonry units to obtain approval or to submit tests as required in this chapter, or such additional tests as the building official may require, shall be cause for rejection of such masonry units.

2119.4 Brick.

2119.4.1 General. Brick shall include masonry units usually $2^1/_4$ inches (57 mm) thick, $3^3/_4$ inches (95 mm) wide, and 8 inches (203 mm) long, and not less than 75 percent solid.

2119.4.2 Tests. Tests shall be conducted in accordance with *Standard Methods of Testing Brick*, ASTM C 67.

2119.4.3 Quality.

2119.4.3.1 Burned clay or shale brick shall conform to either the standard *Specification for Building Brick (Solid Masonry Units made from Clay or Shale)*, ASTM C 62, the standard *Specification for Facing Brick (Solid Masonry Units made from Clay or Shale)*, ASTM C 216 or the standard *Specification for Hollow Brick (Hollow Masonry Units made from Clay or Shale)*, ASTM C 652.

2119.4.3.2 Sand-lime brick shall conform to the *Standard Specification for Concrete Building Brick*, ASTM C 55.

2119.4.3.3 Concrete brick shall conform to the *Standard Specification for Concrete Building Brick*, ASTM C 55.

2119.5 Stone. Stone for masonry shall be hard and durable.

2119.6 Cast stone. Cast stone shall be made of portland cement, aggregates and water with or without admixtures. Cast stone for load-bearing masonry or where exposed to the weather shall have an average compressive strength, at 28 days, of at least 3,000 pounds psi (20.7 MPa) and shall have not more than 7 percent water absorption by weight.

2119.7 Concrete blocks.

2119.7.1 General.

2119.7.1.1 Concrete blocks shall be made of portland cement, water and approved aggregates. The materials shall conform to the requirements for the materials of concrete specified in Chapter 19 (High-Velocity Hurricane Zones), and the finished units shall meet the requirements of this section.

2119.7.1.2 Concrete blocks used for fire-resistive walls rated 2 hours or more, or used for load-bearing or exterior walls, shall have a minimum face shell thickness of $1^1/_4$ inches (32 mm), a minimum web thickness of 1 inch (25.4 mm), and shall have a net cross-sectional area not less than 50 percent of the gross section.

2119.7.1.3 Concrete blocks for other purposes shall have wall and web thickness of not less than $^3/_4$ inch (19 mm).

2119.7.1.4 Where masonry walls are required by this code to be 8 inch (203 mm) thickness, hollow concrete blocks units may be $7^5/_8$ by $7^5/_8$ by $15^5/_8$ inches (195 by 195 by 398 mm) modular dimension with corresponding widths for tie columns and tie beams.

2119.7.2 Quality. Standard units of hollow concrete block shall conform to the *Standard Specification for Hollow Load-Bearing Concrete Masonry Units*, ASTM C 90, except that the maximum moisture content shall not exceed 50 percent of the total absorption.

2119.8 Structural clay tile.

2119.8.1 Limitations. All hollow burned clay wall tile used for fire-resistive walls rated 2 hours or more, load-bearing or exterior walls shall be load bearing tile.

2119.8.2 Tests. Tests shall be conducted in accordance with the *Standard Methods of Sampling and Testing Structural Clay Tile*, ASTM C 212.

2119.8.3 Quality.

2119.8.3.1 Structural clay load-bearing wall tile shall conform to the *Standard Specification of Structural Clay Load-Bearing Wall Tile*, ASTM C 34.

2119.8.3.2 Structural clay floor tile shall conform to the *Standard Specification for Structural Clay Floor Tile*, ASTM C 57.

2119.8.3.3 Structural clay nonload-bearing tile shall conform to the *Standard Specification for Structural Clay NonLoad-Bearing Tile*, ASTM C 56.

2119.9 Gypsum tile.

2119.9.1 Limitations. Precast gypsum shall not be used in load-bearing masonry or in any masonry that will be exposed to the weather.

2119.9.2 Tests. Tests shall be made in accordance with the *Chemical Analysis of Testing Gypsum and Gypsum Products*, ASTM C 471, *Physical Testing of Gypsum Plasters and Gypsum Cement*, ASTM C 472, and *Physical Testing of Gypsum Board Products and Gypsum Partition Tile and Block*, ASTM C 473.

2119.9.3 Quality. Gypsum partition tile or block shall conform to the *Standard Specification for Gypsum Tile or Block*, ASTM C 52, *Chemical Analysis of Testing Gypsum and Gypsum Products*, ASTM C 471, *Physical Testing of Gypsum Plasters and Gypsum Cement*, ASTM C 472, and *Physical Testing of Gypsum Board Products and Partition Tile and Block*, ASTM C 473.

2119.10 Plain concrete. Plain concrete is concrete cast in place and not reinforced, or reinforced only for shrinkage or change of temperature. Plain concrete shall be mixed, placed and cured as specified for concrete in Chapter 19 (High-Velocity Hurricane Zones). The minimum strength of regular concrete shall be not less than 2000 psi (13.8 MPa) in 28 days. The minimum strength of lightweight aggregate concrete shall be not less than 500 psi (3.5 MPa) in 28 days.

2119.11 Plain gypsum concrete. Plain gypsum concrete is gypsum concrete cast in place and either unreinforced or reinforced for shrinkage.

2119.12 Mortar.

2119.12.1 General. Except as otherwise set forth herein, all mortars and the materials therein shall conform to the *Standard Specifications for Mortar of Masonry Units*, ASTM C 270.

2119.12.1.1 The gradation of aggregates for masonry mortar shall be such that the fineness modulus is between 1.20 and 2.35 when determined in accordance with the *Standard Specifications for Aggregate for Masonry Mortar*, ASTM C 144.

2119.12.1.2 Aggregates shall be quarried or washed in fresh water and shall contain not more than $^1/_{20}$ of 1 percent salt by weight.

MORTAR STRENGTH PROPERTY SPECIFICATIONS

Type	Minimum Average Strength (psi) (MPa)
M	2500 (17.2)
S	1800 (12.4)
N	750 (5.2)
O	350 (2.4)

2119.12.1.3 Mortar used to bond unit masonry shall be of Type M, S, N or O and shall comply with either the property specifications set forth hereinafter or the proportion specifications of the standard set forth in Section 2119.12.1.

2119.12.1.4 The type of mortar based on consideration of the location of the unit masonry shall be as follows:

USE OF LOCATION	TYPE OF MORTAR
Below grade foundations and walls	M
Swimming pool walls and retaining walls	M
Fire resistive walls rated 2 hours or more	M or S
Exterior walls and load bearing walls	M or S
Piers less than 32 inches wide	M or S
Partitions	M, S or N
Solid masonry units	One classification less than that above
Mortar or grout under concentrated loads	M
Fences	M, S, N or O
Gypsum	Gypsum

For SI: 1 inch = 25.4 mm.

2119.12.1.5 All solid unit masonry shall be laid in full beds with full end joints. All hollow unit masonry shall be laid with full mortar coverage of the face shells in both horizontal and vertical joints.

SECTION 2120
HIGH-VELOCITY HURRICANE ZONES—ALLOWABLE UNIT STRESSES IN UNIT MASONRY

2120.1 Compression.

2120.1.1 Allowable working compressive stresses in masonry walls shall not exceed the limits in pounds per square inch (MPa) of gross area in the following table:

Unit	Type N or O Mortar	Type M or S Mortar
Brick	200 (1.4)	300 (2.1)
Stone	450 (3.1)	600 (4.1)
Rubble Stone	200 (1.4)	300 (2.1)
Concrete Blocks	100 (0.7)	150 (1.0)
Clay Tile	80 (0.55)	100 (0.7)

2120.1.2 The maximum allowable working stress in plain concrete shall be the following percentage of the ultimate strength of the concrete in compression:

Compression $0.20f'_c$

Shear and diagonal tension $0.02f'_c$

Where f'_c represents the ultimate compressive strength.

2120.2 The shear in unit masonry shall not exceed $^1/_{10}$ the allowable compressive stress.

2120.3 Unreinforced unit masonry shall be assumed to have no value in resisting axial tension. Flexural tension is allowed in unreinforced masonry per ACI 530.

2120.4 Concentrations. Walls of hollow masonry units shall not directly support concentrated loads.

SECTION 2121
HIGH-VELOCITY HURRICANE ZONES—CONSTRUCTION DETAILS

2121.1 General.

2121.1.1 Masonry walls of hollow or solid units or plain concrete shall be constructed as specified in this section.

2121.1.2 Designed reinforced concrete walls, columns and beams shall be as specified in Chapter 19 (High-Velocity Hurricane Zones), except that such designed columns and beams shall be not less than the equivalent of the minimums herein set forth.

2121.1.3 Reinforced concrete required in this section shall comply with Chapter 19 (High-Velocity Hurricane Zones), Reinforced Concrete.

2121.1.4 Second-hand masonry units shall not be used unless they conform to the requirements of this code, are sound and have been thoroughly cleaned and are approved for use by the building official.

2121.1.5 Bond shall be provided by lapping ends in successive vertical courses.

2121.1.6 Minimum No. 9 gauge horizontal joint reinforcing at every alternate course (16-inch (406 mm) spacing), ladder type for reinforced masonry and truss type for all others shall be provided. This reinforcement shall extend 4 inches (102 mm) into tie columns or be tied to structural columns with approved methods where structural columns replace the tie columns.

2121.2 Exterior walls.

2121.2.1 General.

2121.2.1.1 Exterior walls of unit masonry shall have a minimum thickness of 8 inches (203 mm) except as otherwise set forth in Section 2121.2.11 and 2119.7.1.4.

2121.2.1.2 No roof or other members shall be placed to develop direct horizontal thrust on walls unless such walls are specifically designed.

2121.2.1.3 The maximum area of wall panels of 8 inch (203 mm) thick unit masonry, as measured between the concrete members which frame the panel such as the

beams and tie columns, shall not exceed 240 square feet (22.3 m^2), except as set forth in Section 2121.2.2.

2121.2.2 Tie columns.

2121.2.2.1 Concrete tie columns shall be required in exterior walls of unit masonry. Concrete tie columns shall be required at all corners, at intervals not to exceed 16 feet (4.9 m) center-to-center of columns, adjacent to any corner opening exceeding 4 feet (1219 mm) in width, and at the ends of free-standing walls exceeding 2 feet (610 mm) in length. When openings exceed 8 feet (2.4 m) in width, tie columns shall be provided on each side of all such openings. All gable and shed end corners shall have tie columns.

2121.2.2.2 When openings are between 3 and 8 feet (914 mm and 2.4 m) in width, such openings shall have one #5 vertical reinforcing bar at each side. The vertical bars shall be placed in concrete filled cells and shall extend into footings and into tie beams. All such bars shall be continuous from footing to tie beam. All splices, where needed, shall be 30 inches (762 mm) minimum.

2121.2.2.3 Tie columns shall be not less than 12 inches (305 mm) in width. Tie columns having an unbraced height not exceeding 15 feet (4.6 m) shall be not less in thickness than the wall or less than a nominal 8 inches (203 mm), and, where exceeding 15 feet (4.6 m) in unbraced height, shall be not less in thickness than 12 inches (305 mm). The unbraced height shall be taken at the point of positive lateral support in the direction of consideration or the column may be designed to resist applicable lateral loads based on rational analysis.

2121.2.2.4 Tie columns shall be reinforced with not less than four #5 vertical bars for 8 inch by 12 inch (203 mm by 305 mm) columns nor less than four #6 vertical bars for 12 inch by 12 inch (305 mm by 305 mm) columns nor less reinforcing steel than 0.01 of the cross-sectional area for columns of other dimension nor less than may be required to resist axial loads or bending forces. Vertical reinforcing shall be doweled to the footing and splices shall be lapped 30 bar diameters. Columns shall be tied with #2 hoops spaced not more than 12 inches (305 mm) apart.

2121.2.2.5 The concrete tie columns set forth herein are a minimum to limit masonry panel areas and provide an integrated framework for masonry. The spacing of concrete columns for skeleton frame construction, designed as specified in Chapter 19 (High-Velocity Hurricane Zones), may exceed the spacing herein set forth provided the masonry panels have an area less than 240 square feet (22.3 m^2) and the structural system is designed to transmit horizontal wind loads to the columns.

2121.2.2.6 Concrete tie columns designed to limit masonry panel areas may be offset at tie beams or other horizontal members to avoid openings, but the maximum spacing shall not be exceeded.

2121.2.2.7 Concrete columns in load-bearing walls shall be poured only after masonry units are in place. Where masonry walls of skeleton frame construction are laid up after the frame has been erected, adequate anchorage designed by a professional engineer shall be provided. Where structural steel members are made fire-resistive with masonry units, the panel walls shall be bonded to the fire-resistive materials.

2121.2.2.8 Where the minimum spacing of tie columns, as set forth in Section 2121.2.2.1, has been satisfied and structural columns of skeleton frame construction are spaced as specified in Section 2121.2.2.5, provision for resisting the horizontal and vertical loads at the edges of masonry panels abutting door and window openings in masonry walls where openings are not bounded by such reinforced concrete columns shall be considered and, where necessary, transfer the forces through the materials of assembly to the ground.

2121.2.3 Tie beams.

2121.2.3.1 A tie beam of reinforced concrete shall be placed in all walls of unit masonry, at each floor or roof level, and at such intermediate levels as may be required to limit the vertical heights of the masonry units to 16 feet (4.9 m). Well-compacted and confined soil below grade may be considered lateral restraint but only above a point 1 foot (305 mm) below the grade where such restraint begins.

2121.2.3.2 Unless otherwise required by design, all tie beams shall have four #3 ties at 12 inches (305 mm) o.c. at corners and at each bend and at 48 inches (1219 mm) o.c. elsewhere. A tie beam shall be not less in dimension or reinforcing than required for the conditions of loading nor less than the following minimums: a tie beam shall have a width of not less than a nominal 8 inches (203 mm), shall have a height of not less than 12 inches (305 mm) and shall be reinforced with not less than four #5 reinforcing bars placed two at the top and two at the bottom of the beam except that a tie beam using "U" type beam block may be used with the following limitations:

1. Limited to one-story Group R3 occupancy.
2. Limited to unsupported spans of 7 feet (2.1 m).
3. Beam block shall be reinforced with one #7 bar in the top and one #7 bar in the bottom of the pour.
4. Beam block shall provide not less than 14 inches (356 mm) vertical dimension or less than $4^1/_2$ inches (114 mm) horizontal dimension of poured-in-place beam cross-section.
5. Where beam blocks are used, consideration of resistance to uplift caused by wind forces shall be based on only that portion of the dead load above the topmost mortar joint in the wall.

2121.2.3.3 The tie beam shall be continuous. Continuity of the reinforcing in straight runs shall be provided by lapping splices not less than 30 inches (762 mm). Continuity shall be provided at corners by bending two bars from each direction around the corner 30 inches (762 mm) or by adding two #5 bent bars which extend 30 inches (762 mm) each way from the corner. Continuity at columns shall be provided by continuing horizontal rein-

forcing through columns or by bending horizontal reinforcing in the columns a distance of 18 inches (457 mm).

2121.2.3.4 A tie beam shall not be required where floor or roof systems provide a rigid diaphragm of reinforced concrete with a minimum thickness of 4 inches (102 mm) or where a floor or roof system has an equivalent stiffness factor of not less than 0.5 cubic inches, as determined by the moment of inertia divided by the length. (Per foot of width, measured normal to the plane of the diaphragm and adequately anchored).

2121.2.3.5 Changes in level of the beams or structural concrete beams (beam) shall be made at tie columns or structural concrete columns and said tie columns or structural concrete columns shall be continuous from beam to beam.

2121.2.3.6 A tie beam may follow the rake of a gable or shed end if the slope does not exceed 3:12 and the requirements of Sections 2121.2.1.2 and 2121.2.1.3 are met.

2121.2.3.7 The concrete in tie beams shall be placed to bond to the masonry units immediately below and shall not be separated therefrom by wood, felt or any other material which may prevent bond. Felt paper no wider than the width of the cells of the block may be used provided that it is depressed a minimum of 2 inches (51 mm) in one cell of each block.

2121.2.3.8 Tie beams subject to uplift and lateral wind forces shall be sized and designed to resist all such forces. Tie beams over openings shall be sized and designed to resist dead and live loads combined with wind loads, whichever governs.

2121.2.4 Gable end and shed end walls. All masonry structures with gable end and shed end (half gable) walls shall have such end walls constructed of masonry, only in accordance with this section. A horizontal tie beam shall be provided in line with the lower ends of the gables and sheds, except as permitted in Section 2121.2.3.6 above, and designed in accordance with Sections 2121.2.1.2 and 2121.2.1.3, and load requirements as set forth in Chapter 16 (High-Velocity Hurricane Zones). A concrete coping following the rake of the gable, not less than 64 square inches (.04 m^2) in area reinforced with two #5 bars shall be provided. Tie columns at gable and shed ends shall be provided. Any intermediate tie columns required within the gable shall extend to the coping beam. Tie beams resting on masonry which are not subject to uplift and lateral wind forces shall be provided according to Section 2121.2.3.2.

2121.2.5 Parapet walls.

2121.2.5.1 Masonry parapet walls shall be not less than 8 inches (203 mm) thick, shall be reinforced with minimum tie columns and shall be coped with a concrete beam not less than 64 square inches (.04 m^2) in cross-section, reinforced with two #4 reinforcing bars.

2121.2.5.2 A parapet wall exceeding 5 feet (1524 mm) in height above a tie beam or other point of lateral support shall be specifically designed to resist horizontal wind loads.

2121.2.6 Piers.

2121.2.6.1 In any section of a masonry wall of an enclosed structure where openings are arranged to leave sections of walls less than 16 inches (406 mm), such sections shall be steel or reinforced concrete.

2121.2.6.2 Isolated masonry piers of unenclosed structures shall be so constructed that the height of such piers shall not exceed 10 times the least dimension, that the cells are filled with cement grout and reinforced with not less than two #5 bars anchoring the beam to the foundation.

2121.2.7 Cavity walls.

2121.2.7.1 Cavity walls consisting of two separate walls with an air space of not less than 2 inches nor more than 6 inches (51 to 152 mm) may be constructed of solid or hollow-unit masonry provided such walls meet the specific requirements for tie columns and beams set forth in this section and are bonded together at intervals not more than 24 inches (610 mm) apart, vertically and horizontally, by masonry ties or by durable, rigid metal ties 0.10 square inch (64.5 mm^2) in the cross section.

2121.2.7.2 The minimum thickness of the separate walls of cavity wall construction shall be 4 inches (102 mm), and units shall be laid in full beds of portland cement mortar with full-end joints.

2121.2.8 Brick and stone walls. Walls of brick and stone shall be laterally supported by tie columns and beams, or the equivalent thereof, as provided in this section and shall meet these additional requirements:

1. In all brick walls at least every sixth course on both sides of the wall shall be a header course or there shall be at least one full header in every 72 square inches (.05 m^2) of each wall surface.
2. In walls more than 12 inches (305 mm) thick, the inner joints of header courses shall be covered with another header course that shall break joints with the course below.
3. Solid-unit masonry shall comply with the standard *Building Code Requirements for Masonry,* ANSI A41.1.
4. Rubble stone walls shall be 4 inches (102 mm) thicker than is required for solid brick or concrete walls of the same respective heights, but in no part less than 16 inches (406 mm).

2121.2.9 Substitutions.

2121.2.9.1 Where, for architectural reasons or otherwise, it is desirable to reduce the area of any required tie column or tie beam below the specified requirements, the building official may grant such reduction, provided that the area of concrete omitted shall be replaced by reinforcing or structural steel in the ratio 1:(n-1) where "n" is defined as the modular ratio of elasticity (esteel/econcrete).

2121.2.9.2 Where it is desired to substitute for the #5 reinforcing as required by this section, three #4 bars may be substituted to replace two #5 bars.

2121.2.10 Wall additions. Where new walls are connected to existing walls, such connection shall be by means of a starter column of minimum 8 inches by 8 inches (203 mm by 203 mm) dimension reinforced with two #5 bars.

2121.2.11 Chases, recesses and openings.

2121.2.11.1 Unit masonry walls required to be a minimum of 8 inches (203 mm) thick, such as exterior walls, fire walls and bearing walls, may be chased or recessed not deeper than one-half the wall thickness for an area not exceeding 8 square feet (0.74 m^2), provided the horizontal dimension of the chase or recess does not exceed 4 feet (1219 mm) and provided the chasing shall not reduce the dimension of tie beams and tie columns to less than herein required, except as follows:

Exception: Four-inch (102 mm) deep chases or recesses in 8 inch (703 mm) unit masonry walls may be constructed with 4 inch (102 mm) unit masonry panels provided such 4 inch (102 mm) unit masonry panel does not exceed 5 feet (1524 mm) in width, does not exceed 8 feet (2.4 m) in height, is bonded on one vertical side to 8 inch (203 mm) masonry or a tie column, and is not load bearing. Where such panel exceeds 2 feet (610 mm) in width at locations 20 feet (6.1 m) or more above grade in exterior walls, resistance to wind load shall be considered in the design, and a minimum of 4 inch by 8 inch (102 mm by 203 mm) tie column with two #5 vertical bars shall be provided in the free standing end of such 4 inch (102 mm) wall.

2121.2.11.2 Openings shall have lintels of reinforced concrete. Where such lintel is precast or formed separately from a tie beam, it shall bear not less than nominal 8 inches (203 mm) on the masonry, at each end except as may otherwise be approved for compliance with this code by product approval, or after rational analysis, but not less than 4 inches (102 mm). Where such lintel is formed integrally with the tie beam by deepening the tie beam above the opening, and the tie beam itself is capable of safely supporting all loads, the beam may span up to 6 feet (1.8 m) in length and may be deepened not to exceed 8 inches (203 mm) without additional reinforcing. Where the tie beam is deepened in excess of 8 inches (203 mm) with a span less than 6 feet (1.8 m) in length, and the tie beam itself is capable of supporting all loads, the dropped portion shall contain a #3 horizontal bar at the bottom, bent up at each end and fastened to the upper tie beam steel or two #4 horizontal bars. The dropped portion shall bear at least 4 inches (102 mm) on the masonry at each end. Where the span is in excess of 6 feet (1.8 m), the principal beam reinforcing shall be at the bottom of the beam.

2121.2.12 Glass unit masonry. Glass unit masonry shall comply with section 2121.1.12 or shall comply with ACI 530/ASCE 5/TMS 402 and section 2121.2.12.2.

2121.2.12.1 Masonry of glass unit masonry may be used in nonload-bearing exterior or interior walls and in openings which might otherwise be filled with windows, either isolated or in continuous bands, provided the glass unit masonry panels have a thickness of not less than 3½ inches (89 mm) at the mortar joint and the mortared surfaces of the units are satisfactorily treated for mortar bonding.

2121.2.12.2 Glass unit masonry panels for exterior walls shall have a Product Approval.

2121.2.12.3 Exterior unit masonry panels shall be set in recesses at the jambs and, for panels exceeding 10 feet (3 m) in horizontal dimension between supports, at the head as well, to provide a bearing surface at least 1 inch (25 mm) wide along the panel edges; except that when approved by the building official for panels exceeding neither 100 square feet (9.3.m^2) in area nor 10 feet (3 m) in either horizontal or vertical dimension, and situated four stories or less, and less than 52 feet (15.8 m) above grade level, anchorage may be provided by means of non-corrodible perforated metal strips.

2121.2.12.4 Glass unit masonry panels shall have reinforcement in the mortar joints spaced not more than 2 feet (610 mm) apart vertically and below and above any openings within a pane. The reinforcement shall consist of two parallel longitudinal galvanized steel wires, No. 9 gauge or larger, spaced 2 inches (51 mm) apart, and welded to No. 14 or heavier cross wires at intervals not exceeding 8 inches (203 mm), or the equivalent approved by the building official.

2121.2.12.5 Glass unit masonry shall be laid in only Type M or S mortar or equivalent approved material. Both vertical and horizontal mortar joints shall be at least $^1/_4$ inch (6 mm) and not more than $^3/_8$ inch (9.5 mm) thick and shall be completely filled.

2121.2.12.6 Every exterior glass unit masonry panel shall be provided with expansion joints at the sides and top. Expansion joints shall be entirely free of mortar, and shall be filled with resilient material.

2121.2.12.7 Glass masonry units required to provide a fire resistance rating shall comply with Section 2121.1.12.8 or shall be fire tested and listed for their intended use.

2121.2.12.8 View panels in 1-hour fire-resistant walls shall be limited to glass unit masonry panels installed in steel channels, or panel anchor framing may be used where a $^3/_4$-hour fire rating is required. Three-and-seven-eighths inch thick (98 mm) glass masonry unit shall be limited to 120 square feet (1.1 m^2) with no dimension greater than 12 feet (3.7 m) for masonry wall construction or to 94 square feet (8.7 m^2) with no dimension greater than 10.75 feet (3.3 m) for nonmasonry wall construction. Three and one-eighths inch (79 mm) thick glass masonry units shall be limited to 100 square feet (9.3 m^2) with no dimension greater than 10 feet (3 m) for masonry wall construction or to 94 square feet (8.7 m^2) with no dimension greater than 10.75

feet (3.3 m) for nonmasonry wall construction. Three inches (76 mm) thick glass masonry units shall be limited to 100 square feet (9.3 m^2) with no dimension greater than 12 feet (3.7 m) for masonry wall construction or to 94 square feet (8.7 m^2) with no dimension greater than 10 feet (3 m) for nonmasonry wall construction.

View panels in 2-hour fire-resistant walls shall be limited to glass masonry units installed in steel channels and with a water curtain in conformance with NFPA 13 on each side at interior walls or at the interior of exterior walls. Three and seven-eighths inch (98 mm) thick glass masonry units shall be limited to 100 square feet (9.3 m^2) with no dimension greater than 10 feet (3 m).

The view panel assembly shall not exceed 25 percent of the wall separating a tenancy from a corridor or a corridor from an enclosed vertical opening or one fire-rated area from another fire-rated area.

Maximum $^3/_4$ hour fire-rated glass masonry units construction shall be used at nonmasonry wall construction. Panel anchors shall be provided at sill and jambs in nonmasonry wall construction using panel anchor framing. A fire-retardant sealant shall be used at all channel and panel anchor framing. Expansion material at heads and jambs shall be either fibrous glass or mineral wool. All fire-rated glass masonry units and panels shall conform to UL No. 9 and ASTM E 163.

2121.2.12.9 Interior glass masonry unit panels having thickness of $3^7/_8$ inches (98 mm) shall not exceed 250 square feet (23.2 m^2) of unsupported wall surface and interior glass masonry unit panels having thickness of $3^1/_8$ inches (79 mm) shall not exceed 150 square feet (13.9 m^2) of unsupported wall surface nor more than 25 feet (7.6 m) in length nor more than 20 feet (6.1 m) in height between supports.

2121.2.13 Grill block.

2121.2.13.1 Decorative grills or screens constructed of unit masonry laid with cells open through the wall shall be as set forth herein or designs shall be based on rational analysis to resist applicable loads and computations shall be submitted to the building official for approval.

2121.2.13.2 Unit masonry grills or screens as described in this paragraph shall not be load bearing.

2121.2.13.3 Unit masonry in exterior wall shall be laid in Type M or S mortar.

2121.3 Interior bearing walls. Interior-bearing walls shall be constructed as specified in Section 2121.2 for exterior walls, except that interior bearing walls in one-story building of Group H or I occupancy, where not required to be more than 1-hour fire-resistive, may be constructed of 4 inch (162 mm) concrete block not exceeding 9 feet (2.7 m) in height, capped with a reinforced concrete beam not less than 4 inches (102 mm) in width nor less than 12 inches (305 mm) in height, reinforced with two $^1/_2$-inch (12.7 mm) rods, and such walls shall support only a roof or ceiling not in excess of 700 pounds per lineal foot (10.2 kN/m) with no chases or recesses.

2121.4 Fire walls. Firewalls shall be constructed as set forth in Section 2121.2 for exterior walls.

2121.5 Panel walls.

2121.5.1 Panel walls of unit-masonry shall be not less than 8 inches (203 mm) thick and shall be limited in panel dimension as set forth in Section 2121.2.

2121.5.2 Panel walls of reinforced concrete shall be not less than 4 inches (102 mm) thick nor less than required by design as specified in Chapter 19 (High-Velocity Hurricane Zones).

2121.6 Veneered walls.

2121.6.1 Masonry backing.

2121.6.1.1 Veneering or facing on masonry backing shall not be considered as adding any strength to such walls and shall be limited in height above foundations or between proper and adequate supports to 30 feet (9.1 m). Veneering shall be securely anchored to masonry backing by means of substantial, noncorroding metal wall ties, spaced not farther apart than 16 inches (406 mm) vertically or 24 inches (610 mm) horizontally.

2121.6.1.2 Tile veneering, not more than 1 inch (25 mm) thick with individual units not exceeding 20 inches (508 mm) in any dimension and having not more than 200 square inches (.13 cm^2) of surface area with corrugations or scoring on the back side thereof, need not be anchored in accordance with the above requirements but shall be cemented solid to the backing with portland cement mortar so as to provide a continuous integral support to the backing.

2121.6.2 Wood backing.

2121.6.2.1 In all cases, before applying masonry veneer, a substantial waterproofed paper or asphalt-saturated felt, weighing not less than 14 pounds per 100 square feet (0.68 kg/m^2) shall be applied horizontally, shingle fashion, over diagonal sheathing. Horizontal joints in the paper or felt shall be lapped not less than 4 inches (102 mm) and vertical end joints not less than 6 inches (152 mm).

2121.6.2.2 Masonry veneer shall be not less than $3^3/_4$ inches (95 mm) thick and shall be bonded to the backing by means of substantial noncorroding metal wall ties spaced not farther apart than 16 inches (406 mm) vertically and 24 inches (610 mm) horizontally.

2121.7 Partitions.

2121.7.1 The requirements specified herein shall apply to nonbearing interior separations, other than firewalls, of unit masonry construction.

2121.7.2 The lateral distance between vertical supports of nonbearing interior partitions of unit masonry shall not exceed 72 times the actual thickness of the partition, including plaster.

2121.7.3 The height of unit masonry partitions shall not exceed 36 times the actual thickness, including plaster.

2121.7.4 All interior unit masonry partitions shall be designed to meet the lateral live load requirements with corresponding perimeter anchorage supports, in accordance with Section 1618.8.

2121.8 Fences.

2121.8.1 Masonry fences so located on a property that such fence, at the proposed height or by a future addition to height, could be used as a wall of a building shall be constructed with foundations and tie columns as provided for an exterior wall. Such fence shall be capped with a coping beam not less than 64 square inches (.4 m^2) in cross-section reinforced with a minimum of two #4 rods, when not exceeding a height of 5 feet (1.5 m), or shall be capped by a tie beam as provided for exterior walls if exceeding a height of 5 feet (1.5 m).

2121.8.2 Masonry fences, so located on a property that by zoning regulation such fence could not be used as a wall of a building, shall be constructed as follows:

2121.8.2.1 Fences not exceeding 5 feet (1.5 m) in height shall be 8 inches (203 mm) thick and shall not be required to have tie columns, but shall be required to have a coping as provided herein; or such fences may be 4 inches (102 mm) thick with tie columns and coping not less than 8 inches (203 mm) thick.

2121.8.2.2 Fences exceeding 5 feet (1.5 m) in height shall be not less than 8 inches (203 mm) thick and shall have tie columns and tie beams as required for exterior walls.

2121.9 Other masonry walls. Walls of masonry materials or arrangements of masonry units other than those specifically set forth in this chapter shall be in conformance with the general provisions of this code, may be classified by the subject to all or any of the requirements therefor to and any such additional requirements as the building official may prescribe.

SECTION 2122
HIGH-VELOCITY HURRICANE ZONES—REINFORCED UNIT MASONRY

2122.1 Standards. The provisions of ACI 530/ASCE 5, *Building Code Requirements For Masonry Structures*, and the commentary on *Building Code Requirements for Masonry Structures*, are hereby adopted as a minimum; however, the requirement of the standard shall not supersede the specific requirements of this chapter.

2122.2 General.

2122.2.1 Tie columns and tie beams as set forth in Section 2121.2 shall be not required where design and construction are in accordance with the provisions of this section.

2122.2.2 Reinforced unit masonry shall be steel reinforced solid-unit masonry or steel reinforced grouted hollow-unit masonry as set forth herein.

2122.3 The design of buildings and structures of reinforced unit masonry shall be by a professional engineer or registered architect.

2122.4 Special inspector. A Florida-registered architect or professional engineer shall furnish inspection of all reinforced masonry structures.

2122.5 Concrete masonry strength.

2122.5.1 In each test of three prisms, the average of the three may be used as the assumed value of f'_m.

2122.5.2 In no case shall the value of f'_m exceed the lowest break multiplied by 1.25 in any test.

2122.6 Reinforced masonry columns and walls.

2122.6.1 The minimum length of lap for deformed bars in grout, in tension or compression, shall be 48 bar diameters, but not less than 12 inches (305 mm).

2122.6.2 Concentrated loads shall not be assumed distributed across continuous vertical joints, including stack bond joints, unless reinforcing elements are designed and provided to distribute such loads.

2122.6.3 Reinforced masonry bearing walls shall have a nominal thickness of at least $^1/_{30}$ of the unsupported height or width, whichever is the shorter, but not less than 8 inches (203 mm).

2122.6.4 Anchorage requirements.

2122.6.4.1 Reinforced masonry walls shall be securely anchored to adjacent structural members such as roofs, floors, columns, pilasters, buttresses and intersection walls.

2122.6.4.2 Masonry walls shall be anchored to all floors and roofs that provide lateral support to such walls.

2122.6.4.3 Such anchorage shall provide a positive direct connection capable of resisting the horizontal forces as required in Chapter 16 (High-Velocity Hurricane Zones), or a minimum force of 200 pounds per lineal foot (2919 N/m) of wall, whichever is greater.

2122.6.4.4 Required anchors shall be embedded in reinforced grouted cells.

2122.6.4.5 Wood framing connected by nails shall not be considered as acceptable anchorage.

2122.6.5 Mortar and grout.

2122.6.5.1 Vertical cells to be grouted shall provided vertical alignment sufficient to maintain clear, unobstructed, continuous, vertical cores measuring not less than 2 inches by 3 inches (51 mm by 76 mm).

2122.6.5.2 Vertical grout barriers or dams of solid masonry spaced not more than 25 feet (7.6 mm) apart shall be provided across the grout space in the entire height of the wall to control the flow of grout horizontally.

2122.6.5.3 Grout shall be a plastic mix having a maximum slump of 9 inches +/-1 inch (229 +/-25 mm).

2122.6.5.4 Grout shall be placed before any initial set has occurred, but in no case more than $1^1/_2$ hours after the mix-designed water has been added.

2122.6.5.5 Grouting shall be a continuous operation in lifts not exceeding 4 feet (1.2 m) and a maximum pour of 12 feet (23.7 m).

2122.6.5.6 Grouting shall be consolidated between lifts by puddling, rodding or mechanical vibration.

2122.6.5.7 The grouting of any section of wall between control barriers shall be completed in one operation with no interruptions exceeding 1 hour.

2122.6.6 Bearing. Precast floor and roof units supported on masonry walls shall provide minimum bearing of 3 inches (76 mm) and anchorage in accordance with Section 2122.6.4.

2122.6.7 Protection of masonry. Unfinished work shall be stopped back for joining with new work; toothing being permitted only with the approval of the special inspector.

CHAPTER 22

STEEL

SECTION 2201
GENERAL

2201.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel used structurally in buildings or structures.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provision of Sections 2214 through 2224.

SECTION 2202
DEFINITIONS

2202.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meaning shown herein.

STEEL CONSTRUCTION, COLD-FORMED. That type of construction made up entirely or in part of steel structural members cold formed to shape from sheet or strip steel such as roof deck, floor and wall panels, studs, floor joists, roof joists and other structural elements.

STEEL JOIST. Any steel structural member of a building or structure made of hot-rolled or cold-formed solid or open-web sections, or riveted or welded bars, strip or sheet steel members, or slotted and expanded, or otherwise deformed rolled sections.

STEEL MEMBER, STRUCTURAL. Any steel structural member of a building or structure consisting of a rolled steel structural shape other than cold-formed steel, or steel joist members.

SECTION 2203
IDENTIFICATION AND PROTECTION OF STEEL FOR STRUCTURAL PURPOSES

2203.1 Identification. Steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Steel that is not readily identifiable as to grade from marking and test records shall be tested to determine conformity to such standards.

2203.2 Protection. Painting of structural steel shall comply with the requirements contained in AISC 360. Individual structural members and assembled panels of cold-formed steel construction, except where fabricated of approved corrosion-resistant steel or of steel having a corrosion-resistant or other approved coating, shall be protected against corrosion with an approved coat of paint, enamel or other approved protection.

SECTION 2204
CONNECTIONS

2204.1 Welding. The details of design, workmanship and technique for welding, inspection of welding and qualification of welding operators shall conform to the requirements of the specifications listed in Sections 2205, 2206, 2207, 2209 and 2210.

2204.2 Bolting. The design, installation and inspection of bolts shall be in accordance with the requirements of the specifications listed in Sections 2205, 2206, 2209 and 2210.

2204.2.1 Anchor rods. Anchor rods shall be set accurately to the pattern and dimensions called for on the plans. The protrusion of the threaded ends through the connected material shall be sufficient to fully engage the threads of the nuts, but shall not be greater than the length of the threads on the bolts.

SECTION 2205
STRUCTURAL STEEL

2205.1 General. The design, fabrication and erection of structural steel for buildings and structures shall be in accordance with AISC 360.

2205.2 Seismic requirements for steel structures. Reserved.

2205.3 Seismic requirements for composite construction. Reserved.

SECTION 2206
STEEL JOISTS

2206.1 General. The design, manufacture and use of open web steel joists and joist girders shall be in accordance with one of the following Steel Joist Institute (SJI) specifications:

1. SJI K-1.1
2. SJI LH/DLH-1.1
3. SJI JG-1.1

2206.2 Design. The registered design professional shall indicate on the construction documents the steel joist and/or steel joist girder designations from the specifications listed in Section 2206.1 and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, non-SJI standard bridging, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
    1.1. Concentrated loads;
    1.2. Nonuniform loads;
    1.3. Net uplift loads;
    1.4. Axial loads;

1.5. End moments; and

1.6. Connection forces.

2. Special considerations including:

2.1. Profiles for nonstandard joist and joist girder configurations (standard joist and joist girder configurations are as indicated in the SJI catalog);

2.2. Oversized or other nonstandard web openings; and

2.3. Extended ends.

3. Deflection criteria for live and total loads for non-SJI standard joists.

2206.3 Calculations. The steel joist and joist girder manufacturer shall design the steel joists and/or steel joist girders in accordance with the current SJI specifications and load tables to support the load requirements of Section 2206.2. The registered design professional may require submission of the steel joist and joist girder calculations as prepared by a registered design professional responsible for the product design. If requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to standard calculations under this seal and signature, submittal of the following shall be included:

1. Non-SJI standard bridging details (e.g. for cantilevered conditions, net uplift, etc.).
2. Connection details for:

2.1. Non-SJI standard connections (e.g. flush-framed or framed connections);

2.2. Field splices; and

2.3. Joist headers.

2206.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2206.2. Steel placement plans shall include, at a minimum, the following:

1. Listing of all applicable loads as stated in Section 2206.2 and used in the design of the steel joists and joist girders as specified in the construction documents.
2. Profiles for nonstandard joist and joist girder configurations (standard joist and joist girder configurations are as indicated in the SJI catalog).
3. Connection requirements for:

3.1. Joist supports;

3.2. Joist girder supports;

3.3. Field splices; and

3.4. Bridging attachments.

4. Deflection criteria for live and total loads for non-SJI standard joists.
5. Size, location and connections for all bridging.
6. Joist headers.

Steel joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional.

2206.5 Certification. At completion of fabrication, the steel joist manufacturer shall submit a certificate of compliance in accordance with Section 1704.2.2 stating that work was performed in accordance with approved construction documents and with SJI standard specifications.

SECTION 2207
STEEL CABLE STRUCTURES

2207.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

2207.2 Seismic requirements for steel cable. Reserved.

SECTION 2208
STEEL STORAGE RACKS

2208.1 Storage racks. The design, testing and utilization of industrial steel storage racks shall be in accordance with the RMI *Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks.* Racks in the scope of this specification include industrial pallet racks, movable shelf racks and stacker racks, and does not apply to other types of racks, such as drive-in and drive-through racks, cantilever racks, portable racks or rack buildings.

SECTION 2209
COLD-FORMED STEEL

2209.1 General. The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with AISI-NAS. The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-formed steel light-framed construction shall comply with Section 2210.

2209.2 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be designed and constructed in accordance with ASCE 3.

SECTION 2210
COLD-FORMED STEEL LIGHT-FRAMED CONSTRUCTION

2210.1 General. The design, installation and construction of cold-formed carbon or low-alloy steel, structural and nonstructural steel framing shall be in accordance with AISI-General and AISI-NAS.

2210.2 Headers. The design and installation of cold-formed steel box headers, back-to-back headers and single and double L-headers used in single-span conditions for load-carrying purposes shall be in accordance with AISI-Header, subject to the limitations therein.

2210.3 Trusses. The design, quality assurance, installation and testing of cold-formed steel trusses shall be in accordance with AISI-Truss, subject to the limitations therein.

2210.4 Wall stud design. The design and installation of cold-formed steel studs for structural and nonstructural walls shall be in accordance with AISI-WSD.

2210.5 Lateral design. The design of light-framed cold-formed steel walls and diaphragms to resist wind loads shall be in accordance with AISI-Lateral.

2210.6 Prescriptive framing. Detached one- and two-family dwellings and townhouses, up to two stories in height, shall be permitted to be constructed in accordance with AISI-PM, subject to the limitations therein.

SECTION 2211
GABLE END WALLS

2211.1 Gable end walls. Gable endwalls shall be structurally continuous between points of lateral support.

2211.2 Cathedral end walls. Gable endwalls adjacent to cathedral ceilings shall be continuous from the uppermost floor to ceilings shall be continuous from the uppermost floor to ceiling diaphragm or to the roof diaphragm.

SECTION 2212 - 2213
RESERVED

SECTION 2214
HIGH-VELOCITY HURRICANE ZONES—GENERAL—STEEL CONSTRUCTION

2214.1 Design. Steel and iron members shall be designed by methods admitting of rational analysis according to established principles or methods.

2214.2 The design, fabrication and erection of iron and steel for buildings and other structures shall be as set forth in this Chapter. The requirements set forth in Sections 2215 through 2221 herein, inclusive, apply to structural steel for buildings and other structures. Sections 2222 and 2223, apply to cold-formed members of sheet or strip steel and light-gauge steel construction.

2214.3 The following standards, as set forth in Chapter 35 of this code, are hereby adopted.

1. American Institute of Steel Construction, AISC:
   a. Manual of Steel Construction, Allowable Stress Design ASD, AISC, including Supplement No.1 to the *Specification for Structural Steel Buildings*, 2001.
   b. Manual of Steel Construction, Load Resistance Factor Design LRFD, AISC.
   c. Simple Shear Connection, ASD, AISC.
   d. Simple Shear Connections, LRFD, AISC.
   e. Serviceability Design Considerations for Low-Rise Buildings, AISC.
   f. Plastic Design in Steel, AISC.
   g. Engineering for Steel Construction, AISC.
   h. Detailing for Steel Construction, AISC.
   i. Iron and Steel Beams - 1873 to 1952, AISC.
   j. Plastic Design of Braced Multistory Steel Frames, AISC.
   k. Torsional Analysis of Steel Members, AISC.
2. American Iron and Steel Institute, AISI:
   a. Specification for the Design of Cold-Formed Steel Structural Members, AISI.
   b. Fire-Resistant Steel-Frame Construction, AISI.
   c. Fire-Safe Structural Steel & #150; A Design Guide, AISI.
   d. Designing Fire Protection for Steel Trusses, AISI.
   e. Cold-Formed Steel Design Manual, AISI
   f. Specifications for the Design of Light-Gage Cold-Formed Stainless Structural Members, AISI.
   g. Specification for the Criteria for Structural Application of Steel Cables for Buildings, AISI.
   h. Designing Fire Protection for Steel Columns, AISI.
   i. Design Manual for Structural Tubing, AISI.
3. American National Standards Institute/American Society of Civil Engineers, ANSI/ASCE.
   a. Specifications for the Design and Construction of Composite Slabs and Commentary on Specifications for the Design and Construction of Composite Slabs, ANSI/ASCE 3.
   b. Specifications for the Design of Cold-Formed Stainless Steel Structural Members, ANSI/ASCE 8.
   c. Guideline for Structural Condition Assessment of Existing Buildings, ANSI/ASCE 11.
4. American National Standards Institute/American Welding Society, ANSI/AWS.
   a. *Standard Welding Procedure and Performance Qualification,* AWS B2.1.
   b. *Recommended Practice for Stud Welding,* AWS C5.4.
   c. *Structural Welding Code - Steel*, ANSI/AWS D1.1.
   d. *Structural Welding Code - Sheet Metal*, AWS D1.3.
   e. *Structural Welding Code – Reinforcing Steel,* ANSI/AWS D1.4
   f. *Specification for Welding of Sheet Metal*, AWS D9.1.
   g. *Standard for Qualification of Welding Procedures and Welders for Piping and Tubing*, AWS D10.9.
5. American Society for Testing and materials, ASTM.
   a. *Standard Specification for General Requirements for Rolled Steel Plates, Shapes, b. Sheet Piling and Bars for Structural Use*, ASTM A 6.
   b. *Standard Specifications for High-Strength Bolts for Structural Steel Joints,* ASTM A 325.

c. *Standard Specification for Heat-Treated Steel Structural Bolts. 150 KSI Minimum Tensile Strength*, ASTM A 490.

d. *Standard Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process*, ASTM A 525.

6. National Association of Architectural Metal Manufacturers, NAAMM.
   a. *Metal Grating Manual*, NAAMM.
7. Rack Manufacturers Institute/American National Standards Institute, RMI/ANSI.
   a. *Industrial Steel Storage Racks Manual,* RMI.
   b. *Manual of Safety Practices - A code of Practices for the Use of Industrial and Commercial Steel Storage Racks,* RMI/ANSI MH16.2.
8. Research Council on Structural Connections of the Engineering Foundation, RCSCEF.
   a. *Specification for Structural Joints Using ASTM A 325 or A 490 Bolts,* RCSCEF.
9. Shelving Manufacturers Association, a Products Section of the Material Handling Institute/American National Standards Institute, SMA/ANSI.
   a. *Specification for the Design, Testing, Utilization and Application of Industrial Grade Steel Shelving*, SMA/ANSI MH281.
10. Steel Deck Institute, Inc., SDI.
    a. *Standard Practice Details*, SDI.
    b. *SDI Manual of Construction with Steel Deck,* SDI.
    c. *Deck Damage and Penetrations,* SDI.
    d. *Steel Deck Institute Design Manual.*
    e. *LRFD Design Manual for Composite Beams and Girders with Steel Deck,* SDI.
    f. *Diaphragm Design Manual,* SDI.
11. Steel Joist Institute, SJI.
    a. *Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders,* SJI.
    b. *Structural Design of Steel Joist Roofs to Resist Ponding Loads, Technical Digest No. 3*, SJI.
    c. *Vibration of Steel Joist-Concrete Slab Floors, Technical Digest No. 5*, SJI.
    d. *Structural Design of Steel Joist Roofs to Resist Uplift Loads, Technical Digest No. 6,* SJI.
    e. *Welding of Open Web Steel, Technical Digest No. 8*, SJI.
    f. *Handling and Erection of Steel Joists and Joist Girders, Technical Digest No. 9,* SJI.
    g. *60-Year Steel Joist Manual,* SJI.
12. Steel Structures Painting Council, SSPC.
    a. *Steel Joist Shop Paint, SSPC* - Paint 15.
    b. *A Guide to the Shop Painting of Structural Steel, SSPC/AISC.*
13. Underwriters Laboratories, Inc., UL.
    a. *Test for Uplift Resistance of Roof Assemblies,* UL 580.
14. Welded Steel Tube Institute, Inc., WSTI.
    a. *Manual of Cold Formed Welded Structural Steel Tube.*

2214.4 Workmanship. Steel construction shall be in conformance with the tolerances, quality and methods of construction as set forth in Section 2214.3.

2214.5 Statements of the structural responsibilities of architects and professional engineers on the design of structural steel systems.

2214.5.1 The structural engineer of record and/or the architect of record shall be responsible for all aspects of the structural design including the design of components and connections. The structural construction documents may assign to the fabricator the responsibility for implementing the design as specified and for maintaining fabrication and erection tolerances and for ensuring the fit and erectability of the structure.

2214.5.2 The structural engineer of record and/or the architect of record may elect to detail all connections on the structural construction documents and require fabrication in accordance with those details.

2214.5.3 Alternately the structural engineer of record and/or the architect of record may permit the fabricator to select or modify connections subject to review and approval by the structural engineer of record and/or the architect of record. In that case, the structural construction documents shall specify criteria for the design of connections and shall identify the nature, magnitude and location of all design loads.

2214.5.4 The structural engineer of record and/or the architect of record shall require the submission of fabrication and erection drawings for review as an indication that his or her intent has been understood and the specified criteria have been used.

2214.5.5 Structural submittals requiring engineering input, such as dealing with substitute connections, shall be accompanied by design calculations and shall bear the impressed seal, signature and date of the specialty engineer who prepared them.

SECTION 2215
HIGH-VELOCITY HURRICANE ZONES—MATERIAL

2215.1 Steel. Steel shall conform to the physical requirements set forth in the applicable standard in Section 2214.3.

2215.2 High-strength steel bolts. High-strength steel bolts shall conform to the requirements set forth in the applicable standards of Section 2214.3.

2215.3 Used and damaged material. All steel shall be straight and true, and any section damaged to be out of shape shall not

be used. Steel previously used or fabricated for use or fabricated in error shall not be used except with the approval of the building official. Filled holes or welds shall not be concealed. Straightened or retempered fire-burned steel shall not be used except with the approval of the building official.

2215.4 Tests. The building official may require tests and/or mill records to determine the quality of materials.

2215.5 Ribbed bolts. Ribbed bolts shall be made from carbon manganese steel with a minimum tensile strength of 70,000 per square inch (482.7 MPa).

SECTION 2216
HIGH-VELOCITY HURRICANE ZONES—DESIGN LOADS

2216.1 Design shall be based on the dead, live, wind and other loads set forth in Chapter 16 (High-Velocity Hurricane Zones) and the additional stress considerations set forth in this Chapter.

SECTION 2217
HIGH-VELOCITY HURRICANE ZONES—MINIMUM THICKNESS OF MATERIAL

2217.1 The minimum thickness of material shall not be less than as set forth in the applicable standards listed in Section 2214.3 except as otherwise set forth herein.

SECTION 2218
HIGH-VELOCITY HURRICANE ZONES—CONNECTIONS

2218.1 Connections shall conform to the requirements of the applicable standards set forth in Section 2214.3.

2218.2 A Florida-registered architect or professional engineer shall inspect the welding and high-strength bolting of structural steel framing and welding, bolting and fastening of lightweight material systems and metal sidings of buildings with areas exceeding 1,000 square feet (93 m^2).

2218.3 Welding in the shop or field may be done only by AWS certified welders.

SECTION 2219
HIGH-VELOCITY HURRICANE ZONES—TUBULAR COLUMNS

2219.1 Tubular columns and other primary compression members, excluding secondary posts and struts not subject to bending and whose design load does not exceed 2,000 pounds (8900 N), shall have a minimum least dimension of $2^1/_2$ inches (64 mm) and a minimum wall thickness of $^3/_{16}$ inch (4.8 mm).

2219.2 Tubular members when filled with concrete shall have $^1/_4$-inch diameter (6.4 mm) pressure relief holes drilled through the shell, within 6 inches (152 mm) of the top and bottom of the exposed length of the member and one hole at midheight.

2219.3 Concrete fill in tubular members shall not be assumed to carry any of the load except in compression members having a least dimension of 8 inches (203 mm) or greater and having a 1 inch (25 mm) inspection hole in the plate at each end.

SECTION 2220
HIGH-VELOCITY HURRICANE ZONES—PROTECTION OF METAL

2220.1 All field rivets, bolts, welds and abrasions to the shop coat shall be spot painted or treated with the material used for the shop coat, or an equivalent comparable to the shop coat, after removal of all objectionable deleterious materials.

2220.2 Primary structural steel members, except where intended to be encased in concrete, shall have one shop coat of paint and, if exposed to the atmosphere or elements in the completed building or structure shall receive a second shop coat of paint or be field painted in addition to the initial shop coat with lead, graphite or asphalt paint or other approved coating compatible with the shop coat, except as herein provided. Surfaces of members in contact with, but not encased in, concrete or masonry shall be asphalt coated or otherwise effectively coated where the thickness of the metal is $^3/_{16}$ inch (4.8 mm) or less.

2220.3 Members having a corrosion-resistive metallic coating of zinc of not less than G90 Coating Designation (1.25 ounces; 35 grams) or other equivalent approved coating are not required to have the shop and field coating.

2220.4 Where structural members are exposed to industrial fumes, fresh and/or salt water, salt water spray, and other corrosive agents, such members shall be effectively protected with a corrosion-resistive metallic or other equivalent approved coating.

2220.5 Corrosion-resistant steels with or without painting or coating may be approved where sufficient test or other factual data establishing the satisfactory performance under the particular exposure conditions or usage is submitted to and approved by the building official.

SECTION 2221
HIGH-VELOCITY HURRICANE ZONES—GENERAL—OPEN WEB STEEL JOISTS

2221.1 Standards. Open web steel joists shall comply with the standards set forth in Section 2214.3.

2221.2 Statements of responsibilities of architects and professional engineers on the design of structural systems using open web steel joists.

2221.2.1 The structural construction documents shall designate the standards for joist design and shall indicate layout, end supports, anchorage, bridging requirements, etc., including connections to walls. The structural construction documents shall indicate special requirements for concentrated loads, openings, extended ends and resistance to uplift.

2221.2.2 The structural engineer of record and/or the architect of record shall require structural submittals for the structural engineer of record's review and/or the architect of record's review as an indication that his or her intent has been understood and that the specified criteria have been

used. The structural submittals, unless catalog submittals, shall bear the impressed seal, signature and date of the specialty engineer who prepared them.

2221.2.3 The structural submittals shall identify the specific project, shall list the design criteria and shall show all joist location information and details necessary for proper installation.

2221.3 Design.

2221.3.1 Open web steel joist systems shall be designed to accommodate the loads and forces set forth in Chapter 16 (High-Velocity Hurricane Zones).

2221.3.2 Net uplift forces for all zones, applied to the joist systems, shall be clearly indicated on the structural construction documents.

2221.3.3 Where the net uplift force is equal to or greater than the gravity load of construction, all web and bottom chord members shall comply with slenderness ratio requirements for top chord and for compression members other than top chord as provided for in the standards set forth in Section 2214.3(11).

2221.3.4 The slenderness ratio about the horizontal axis can be used in determining the capacity of the top chord provided the top chord is stayed laterally by the deck system. The top chord for superimposed dead and live loads shall be considered to be stayed laterally if:

1. A poured-in-place concrete slab is in direct contact with the top chord.
2. A light gauge steel deck complying with Section 2222 is fastened to the top chord.
3. Any other approved deck system such that attachments of the top chord to the deck are capable of resisting a lateral force specified in the standard set forth in Section 2214.3 and the spacing of the fasteners does not exceed 24 inches (610 mm) along the chord.

2221.3.5 When the bottom chord under net uplift loads is in compression, the bottom chord shall be stayed laterally by a bracing system adequately anchored at each end.

2221.3.6 Fastenings shall be bolting, welding or other approved fastening device that provides a resistance to lateral movement as required by rational analysis or by test, but not less than 400 pounds per foot (5838 N/m).

2221.4 Connections. The joints and connections of members of steel joists shall be made by welding or bolting.

2221.5 Bridging.

2221.5.1 All bridging and anchors shall be completely installed before application of any construction loads. Bridging shall secure the chords against lateral movement and shall position and hold the joists vertical and in a straight line.

2221.5.2 Bridging members shall be of material having a thickness not less than:

1. $^1/_8$ inch (3.2 mm) for hot-rolled sections.
2. 16 gauge for cold-formed sections.
3. $^1/_2$ inch (12.7 mm) diameter for round members.

2221.5.3 Bridging shall be connected to the chords of the joists by welding, bolting or other positive mechanical means. Each attachment shall be capable of resisting a horizontal force specified in the standard set forth in Section 2214.3.

2221.5.4 Bridging shall be connected to the chords of the joists by bolting or welding at all points of contact and shall be capable of transmitting the forces required of the bridging members. The ends of all bridging lines shall terminate at walls or beams and shall be anchored thereto and where anchorage is not possible, stability shall be provided by additional bracing.

2221.5.5 Where uplift forces are a design requirement, a single line of continuous bottom chord bridging shall be provided near the first panel points.

2221.6 End supports and anchorage.

2221.6.1 Joists shall not bear directly on unit masonry unless masonry is designed as engineered unit masonry with properly reinforced, grout-filled continuous bond beam.

2221.6.2 The ends of every joist shall be bolted, welded or encased in concrete at each point of bearing to provide not less resistance in any direction than 50 percent of the Steel Joist Institute (SJI) rated end reaction horizontally and 100 percent of the net uplift reaction specified in the structural construction documents.

2221.6.3 The ends of joists shall have a minimum bearing, on reinforced concrete and steel supports as specified in the standard set forth in Section 2214.3(11).

2221.7 Fabrication. Steel joists shall be manufactured by plants having a certificate of competency issued by the authority having jurisdiction.

2221.8 Shop standards. The applicant for building permit will not be required to submit shop drawings for steel joists except as set forth in Sections 2221.8.1 and 2221.8.2.

2221.8.1 The master permit drawings required by this code shall describe all steel to be used in the proposed building or structure, including open-web frames and trusses, and shall detail member sizes, spacing, attachment and welding including provision for unusual loading such as concentrated loads, unusual cantilevering, soffit framing and continuity except that such prime drawings may designate standard open-web steel joists by Steel Joist Institute (SJI) number and symbol.

2221.8.2 Where standard open-web steel joists are designated on the prime drawings by customary SJI numbers or symbols, the manufacturer, fabricator or supplier may be required to submit design computations, stress diagrams, sizes of members and sizes of welds to the building official for approval before installation to demonstrate that the units to be provided do, in fact, comply with the specifications and performance standards set forth by SJI. Only design computations prepared by a professional engineer will be accepted. Resubmission of any fabricator designs so submitted and approved will not be required for each subsequent job. Proof of the characteristics of the material may be required for any steel for which a minimum yield strength in

excess of 36,000 per square inch (248.2 MPa) is used as the basis of design.

SECTION 2222
HIGH-VELOCITY HURRICANE ZONES—COLD-FORMED STEEL CONSTRUCTION

2222.1 Cold-formed steel construction shall include individual structural members, structural decks or wall panels, and nonstructural roofing, siding and other construction elements formed from sheet or strip steel and as set forth in Section 2214.3(2).

2222.2 Standards. Cold-formed steel used in structural applications shall conform to the Standards set forth in Section 2214.3(2).

2222.2.1 Galvanizing as referred to herein is to be zinc coating conforming to the standard set forth in Section 2214.3(5)(d).

2222.3 Individual structural members. Design, fabrication and erection of individual cold-formed steel structural members shall be as set forth herein.

2222.3.1 All structural members shall be positively connected to resist the loads set forth in Chapter 16 (High-Velocity Hurricane Zones).

2222.3.2 All connections shall be by welding, riveting, bolting or other approved fastening devices or methods providing positive attachment and resistance to loosening. Fasteners shall be of compatible material.

2222.3.3 Cables and rods shall not be used as lateral bracing in habitable structures. Lateral bracing, when used, shall have a slenderness ratio of 300 or less, unless restricted by any other section of this code.

2222.3.4 Doors and windows in preengineered metal building systems shall be designed as a structural component member and shall conform to all requirements in this chapter.

2222.3.5 All doors shall be anchored as part of the frame in the closed position.

2222.3.6 No increase in strength shall be allowed for the effect of cold work.

2222.4 Structural sheets. Decks and panels with or without an approved fill material may be designed as diaphragms in accordance with *Diaphragm Design Manual of the Steel Deck Institute*, provided other limitations in this code are complied with.

2222.4.1 Poured fill on roof and floor decks shall not be assumed to have any structural value to support or resist vertical or lateral loads or to provide stability or diaphragm action unless so designed, and poured fill and/or applied materials do not degrade when subjected to moisture.

2222.4.2 Positive attachment of sheets shall be provided to resist uplift forces. Attachment shall be as set forth in Section 2222.3.1 and as required by rational analysis, and/or tests, but not less frequently than the following maximum spacing:

1. One fastener shall be placed near the corner of each sheet or at overlapping corners of sheets.
2. Along each supporting member, the spacing of fasteners shall not exceed 8 inches (203 mm) on centers at ends of sheets or 12 inches (305 mm) on centers.
3. The spacing of edge fasteners between panels, and between panels and supporting members, parallel to the direction of span, where continuous interlock is not otherwise provided shall be not more than 12 inches (305 mm) on centers.
4. Fastening shall be by bolting, welding or other approved fastening device that provides a resistance to lateral movement as required by rational analysis or by test, but not less than 400 pounds per lineal foot (5838 N/m).
5. Poured lightweight concrete fill will be acceptable as continuous interlock.
6. Attachment to the supporting structure shall be provided at all perimeters and discontinuities by fasteners spaced at no more than 8 inches (203 mm) on center.
7. Wall panels shall be attached as set forth in Section 2222.4.2(1),(2) and (3).

2222.4.3 Metal siding and roof panels shall be not less than 24 gauge.

Exception: Roof panels having an approved fill material designed to act as a diaphragm may use a lighter deck gauge provided that the product approval for the fill material allows its use over the same deck gauge, but in no case shall the deck be less than 26 gauge. The permit applicant shall provide the building official with signed and sealed structural calculations for the diaphragm design prepared by a licensed architect or engineer proficient in structural design. The diaphragm design shall comply with the applicable requirements of Chapter 16 and Chapter 22 (High-Velocity Hurricane Zones).

2222.4.4 Deflection of metal siding and roof panels shall not exceed L/240.

2222.4.5 The bending stress of metal siding and roof panels shall be designed using a safety factor of not less than 2.5.

2222.4.6 Minimum roof decking uplift loads shall comply with the design requirements of Chapter 16 (High-Velocity Hurricane Zones) utilizing rational analysis, but not less than UL 580 Class 90.

2222.4.7 Reserved.

2222.4.8 Metal siding and roof panels shall be designed, where possible, to be continuous over two or more spans.

2222.5 Nonstructural sheets. Steel sheet sections not suitable by rational analysis for self-supporting structural sheets shall be termed roofing and siding. Roofing and siding shall be used only over solid wood sheathing or equivalent backing.

2222.5.1 Attachment of sheets shall be as set forth in Section 2222.4.2

2222.6 Protection of metal. All members shall be treated with protective paint coatings or equivalent protection except as permitted in Sections 2222.6.1 or 2222.6.2.

2222.6.1 All steel sheets having a thickness of less than 20 gauge, i.e., materials of higher gauge, shall be galvanized in accordance with the standards of Section 2214.3(5)(d) herein to provide a minimum coating designation of G90.

2222.6.2 Abrasions or damages to the protective coating shall be spot-treated with a material and in a manner compatible to the shop protective coating.

2222.7 Welding shall conform to the requirements of Sections 2214.3, 2218.2 and 2218.3.

SECTION 2223
HIGH-VELOCITY HURRICANE ZONES—PRE-ENGINEERED, PREFABRICATED METAL BUILDING SYSTEMS AND COMPONENTS (PRE-ENGINEERED STRUCTURES)

2223.1 Scope. Metal buildings (preengineered structures) shall include, but not be limited to, tapered or straight web structural steel frames and predominantly cold formed steel secondary components, including, but not limited to, girts, purlins, roof sheets, wall sheets, etc.

2223.2 Standards. Frames and components shall comply with the standards set forth in Section 2214.3.

2223.3 Structural construction documents for pre-engineered structures shall indicate the necessary measures for adapting the structures to the specific site. The structural construction documents shall indicate all openings, concentrated loads and other special requirements. Foundation conditions assumed in the design shall be indicated as well as the location and magnitude of building reactions on that foundation under all design conditions.

2223.4 Structural submittals.

2223.4.1 The structural engineer of record and/or the architect of record shall require structural submittals for review as an indication that his or her intent has been understood and that the specified criteria have been used. The structural submittals shall bear the impressed seal, signature and date of the specialty engineer who prepared them.

2223.4.2 The structural submittals shall identify the project and list loading and other design criteria. The fabrication and erection drawings shall indicate in detail the construction of the standard structure used or as modified to comply with the requirements of the particular project. The fabrication and erection drawings shall indicate all connection details, openings and other special details. The fabrication and erection drawings shall show the magnitude and location of building reactions on the foundation under all design conditions. Calculations supporting the design shall be submitted not only for the standard structure, but also for modifications and for related components requiring structural design.

2223.5 Design. A building or component system in this section shall have a structural engineer of record and/or architect of record responsible for the overall design and performance of the entire building including the foundation and the anchorage of the preengineered metal systems buildings thereto. The structural engineer of record and/or the architect of record shall provide the structural construction documents necessary for permitting.

2223.5.1 Calculations for drift and deflection of the metal system building shall be by the specialty engineer.

2223.5.2 Calculations for deflection shall be done using only the bare frame method. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed. Drift shall follow AISC serviceability design considerations for low-rise buildings. The use of composite stiffness for deflection calculations shall be permitted only when actual calculations for the stiffness are included with the design for the specific project. When maximum deflections are specified by the structural construction documents, calculations shall be included in the design data.

2223.5.3 The manufacturer shall design the metal system building and/or component system in accordance with the provisions of Chapter 16 (High-Velocity Hurricane Zones), and the design shall be signed, dated and sealed by the specialty engineer and reviewed by the structural engineer of record and/or the architect of record. The manufacturer of the metal system building and or component system shall be responsible to provide all reactions to the structural engineer of record and/or the architect of record.

2223.5.4 Fastenings shall be by bolting, welding or other approved fastening device that provides a resistance to lateral movement as required by rational analysis or by test, but not less than 400 pounds per lineal foot (5838 N/m).

2223.6 Permitting.

2223.6.1 The applicant for a building permit will be required to submit structural construction documents indicating the overall building dimensions, haunch and eave heights, roof slopes, bay spacing, column locations, approximate frame and component profiles, foundation details and fire rating details and the magnitude and location of building reactions on the foundation under all design conditions prior to the issuance of the permit.

2223.6.2 Prior to the commencement of erection of the structure, the structural submittal and calculations, including, but not limited to, fabrication and erection drawings signed, dated and sealed by the specialty engineer and reviewed by the architect of record and/or the structural engineer of record, shall be submitted and approved by the building department.

2223.6.3 Where the roofing and siding are structural sheets consisting of clip-mounted standing seam or other direct screw attached panel system and are in themselves the finished product, a separate roofing permit shall not be required.

2223.7 Fabrication and erection.

2223.7.1 Fabrication shall be done in accordance with the standards mentioned above. The manufacturer shall provide a letter certifying that the building has been designed and

fabricated in accordance with the above referenced standards.

2223.7.2 Temporary bracing shall be provided during erection and shall remain in place until all structural frames, purlins, girts, flange braces, cable or rod bracing and sheets used as diaphragms have been installed,

2223.8 Roof sheets, wall sheets, roof panels and wall panels.

2223.8.1 All building envelope components shall have Product Approval.

2223.8.2 The fusion welding of structural members and structural sheets defined in Section 2222.4 and less than 22 gauge (0.0299 inch nominal) in thickness shall have minimum of $^{5}/_{8}$ inch (17 mm) diameter welds through weld washers not less than 14-gauge in thickness and 1 inch (25 mm) in diameter, contoured if necessary to provide continuous contact, or an equivalent device.

2223.8.3 Clip-mounted standing-seam roof sheets shall not be used as diaphragms nor shall they be considered as adequate lateral bracing of the flange of the secondary member to which they are attached unless one or both of these features are designed into the sheathing system and the manufacturer can certify by testing and/or analysis that such capabilities exist and are appropriately defined.

2223.8.4 Structural standing-seam roof sheets shall be a minimum of 24 gauge [0.0239 inch (.6 mm) nominal] in thickness.

2223.8.5 Direct screw attached roof and wall sheets may be used as diaphragms provided the sheets are a minimum of 24 gauge [0.0239 inch (.6 mm) nominal] in thickness. Additionally, these sheets shall be considered to laterally brace the flange of the secondary member to which they are attached.

2223.8.6 See Section 2222 for additional requirements for roof sheets, wall sheets, roof panels and wall panels.

2223.9 Roof purlins and wall girts.

2223.9.1 Adequate bracing shall be provided to the compression flanges of secondary members with special attention to those members subject to uplift or outward pressures where no roof or wall sheets are attached to provide such bracing. Sag rods shall not be considered bracing when located in the neutral axis of the web of the secondary members.

2223.9.2 Roof purlins and wall girts shall be laterally braced in addition to relying on deck and panel diaphragm action.

2223.9.3 The ends and bearing points of secondary members shall be designed to carry 100 percent of dead, live and collateral loads superimposed on them by wind.

2223.9.4 Upward or outward forces of wind are to be calculated without live and collateral loads. When downward or inward forces caused by wind are involved, the dead forces plus collateral load forces must be combined but the roof live load may be omitted.

2223.10 Individual structural members.

2223.10.1 Cables and rods shall not be used as lateral bracing in habitable structures. Lateral bracing, when used, shall have a slenderness ratio of 300 or less, unless restricted by any other section of this code.

2223.10.2 Doors and windows in preengineered metal building systems shall have Product Approval.

2223.10.3 All doors shall be anchored as part of the frame in the closed position.

2223.10.4 No increase in strength shall be allowed for the effect of cold work.

2223.10.5 See Section 2222 for additional requirements for pre-engineered metal building systems and components.

2223.11 Inspection.

2223.11.1 Metal system buildings shall be inspected by a Florida-registered architect or professional engineer.

2223.11.2 Metal systems building construction shall comply with the requirements of the AISC Metal Building Certification Program, Category MB Certified.

2223.11.3 Letter of certification. The metal systems building manufacturer shall submit a written certification prepared, signed, dated and sealed by the specialty engineer registered to practice in the State of Florida verifying that the building system design and metal wall and roof system design including, but not limited to, panels, clips, support system components, etc., meet the indicated loading requirements and codes of the authorities having jurisdiction. The certification shall reference specific dead loads, live loads, wind loads/speeds, tributary area load reductions (if applicable), collateral loads, end use categories, crane loads, accessory loads, load combinations, governing code bodies including year and load applications. The letter of certification shall be provided to the structural engineer of record and/or the architect of record, the special inspector and the building department prior to the issuance of the certificate of occupancy.

2223.11.4 Structural construction documents demonstrating compliance with this code shall be reviewed and approved by the special inspector prior to the issuance of a certificate of occupancy.

SECTION 2224
HIGH-VELOCITY HURRICANE ZONES—CHAIN LINK FENCES

2224.1 Chain link fences in excess of 12 feet (3.7 m) in height shall be designed according to the loads specified in Chapter 16 (High-Velocity Hurricane Zones).

2224.2 Chain link fences less than 12 feet (3.7 m) in height shall be designed according to the loads specified in Chapter 16 (High-Velocity Hurricane Zones) or may be constructed to meet the minimum requirements specified in Table 2224.

TABLE 2224
CHAIN LINK FENCE MINIMUM REQUIREMENTS

Fence Height (ft)	Terminal Post Dimensions (in inches) (o.d. x wall thickness)	Line Post Dimensions (o.d. x wall thickness) (in inches)	Terminal Post Concrete Foundation Size (diameter x depth) (in inches)	Line Post Concrete Foundation Size (diameter x depth) (in inches)
Up to 4	2 3/8 x 0.042	1 5/8 x 0.047	10 x 24	8 x 24
Over 4 to 5	2 3/8 x 0.042	1 7/8 x 0.055	10 x 24	8 x 24
Over 5 to 6	2 3/8 x 0.042	1 7/8 x 0.065	10 x 24	8 x 24
Over 6 to 8	2 3/8 x 0.110	2 3/8 x 0.095	10 x 36	10 x 36
Over 8 to 10	2 7/8 x 0.110	2 3/8 x 0.130	12 x 40	10 x 40
Over 10 to 12	2 7/8 x 0.160	2 7/8 x 0.120	12 x 42	12 x 42

For SI: 1 inch = 25.4 mm.

NOTES:

1. This table is applicable only to fences with unrestricted airflow.
2. Fabric: 121/2 gauge minimum.
3. Tension bands: Use one less than the height of the fence in feet evenly spaced.
4. Fabric ties: Must be minimum the same gauge of the fabric.
5. Fabric tie spacing on the top rail: Five ties between posts, evenly spaced.
6. Fabric tie spacing on line posts: One less than height of the fence in feet, evenly spaced.
7. Either top rail or top tension wire shall be used.
8. Braces must be used at terminal posts if top tension wire is used instead of top rail.
9. Post spacing: 10 foot (3 m) on center maximum.
10. Posts shall be embedded to within 6 inches (152 mm) from the bottom of the foundation.
11. In order to follow the contour of the land, the bottom of the fence may clear the contour of the ground by up to 5 inches (127 mm) without increasing table values to the next higher limit.

CHAPTER 23
WOOD

SECTION 2301
GENERAL

2301.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of wood members and their fasteners.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 2314 through 2330.

2301.2 General design requirements. The design of structural elements or systems, constructed partially or wholly of wood or wood-based products, shall be in accordance with one of the following methods:

1. Allowable stress design in accordance with Sections 2304, 2305 and 2306.
2. Load and resistance factor design in accordance with Sections 2304, 2305 and 2307.
3. Conventional light-frame construction in accordance with Sections 2304 and 2308.

Exception: Buildings designed in accordance with the provisions of the AF&PA WFCM shall be deemed to meet the requirements of the provisions of Section 2308.

2301.3 Nominal sizes. For the purposes of this chapter, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions (see Section 2304.2).

SECTION 2302
DEFINITIONS

2302.1 Definitions. The following words and terms shall, for the purposes of this chapter, have the meanings shown herein.

ACCREDITATION BODY. An approved, third-party organization that is independent of the grading and inspection agencies, and the lumber mills, and that initially accredits and subsequently monitors, on a continuing basis, the competency and performance of a grading or inspection agency related to carrying out specific tasks.

BRACED WALL LINE. A series of braced wall panels in a single story that meets the requirements of Section 2308.3.

BRACED WALL PANEL. A section of wall braced in accordance with Section 2308.9.3.

COLLECTOR. A horizontal diaphragm element parallel and in line with the applied force that collects and transfers diaphragm shear forces to the vertical elements of the lateral-force-resisting system and/or distributes forces within the diaphragm.

CONVENTIONAL LIGHT-FRAME WOOD CONSTRUCTION. A type of construction whose primary structural elements are formed by a system of repetitive wood-framing members. See Section 2308 for conventional light-frame wood construction provisions.

CRIPPLE WALL. A framed stud wall extending from the top of the foundation to the underside of floor framing for the lowest occupied floor level.

DIAPHRAGM, UNBLOCKED. A diaphragm that has edge nailing at supporting members only. Blocking between supporting structural members at panel edges is not included. Diaphragm panels are field nailed to supporting members.

DRAG STRUT. See "Collector."

FIBERBOARD. A fibrous, homogeneous panel made from lignocellulosic fibers (usually wood or cane) and having a density of less than 31 pounds per cubic foot (pcf) (497 kg/m^3) but more than 10 pcf (160 kg/m^3).

GLUED BUILT-UP MEMBER. A structural element, the section of which is composed of built-up lumber, wood structural panels or wood structural panels in combination with lumber, all parts bonded together with structural adhesives.

GRADE (LUMBER). The classification of lumber in regard to strength and utility in accordance with American Softwood Lumber Standard DOC PS 20 and the grading rules of an approved lumber rules-writing agency.

HARDBOARD. A fibrous-felted, homogeneous panel made from lignocellulosic fibers consolidated under heat and pressure in a hot press to a density not less than 31 pcf (497 kg/m^3).

NAILING, BOUNDARY. A special nailing pattern required by design at the boundaries of diaphragms.

NAILING, EDGE. A special nailing pattern required by design at the edges of each panel within the assembly of a diaphragm or shear wall.

NAILING, FIELD. Nailing required between the sheathing panels and framing members at locations other than boundary nailing and edge nailing.

NATURALLY DURABLE WOOD. The heartwood of the following species with the exception that an occasional piece with corner sapwood is permitted if 90 percent or more of the width of each side on which it occurs is heartwood.

Decay resistant. Redwood, cedar, black locust and black walnut.

Termite resistant. Redwood and Eastern red cedar.

NOMINAL SIZE (LUMBER). The commercial size designation of width and depth, in standard sawn lumber and glued-laminated lumber grades; somewhat larger than the standard net size of dressed lumber, in accordance with DOC PS 20 for sawn lumber and with the AF&PA NDS for glued-laminated lumber.

PARTICLEBOARD. A generic term for a panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from

fibers. The cellulosic material is combined with synthetic resin or other suitable bonding system by a process in which the interparticle bond is created by the bonding system under heat and pressure.

PREFABRICATED WOOD I-JOIST. Structural member manufactured using sawn or structural composite lumber flanges and wood structural panel webs bonded together with exterior exposure adhesives, which forms an "I" cross-sectional shape.

PRESERVATIVE-TREATED WOOD. Wood (including plywood) pressure treated with preservatives in accordance with Section 2303.1.8.

SHEAR WALL. A wall designed to resist lateral forces parallel to the plane of a wall.

Shear wall, perforated. A wood structural panel sheathed wall with openings, that has not been specifically designed and detailed for force transfer around openings.

Shear wall segment, perforated. A section of shear wall with full-height sheathing that meets the height-to-width ratio limits of Section 2305.3.4.

STRUCTURAL COMPOSITE LUMBER. Structural member manufactured using wood elements bonded together with exterior adhesives. Examples of structural composite lumber are:

Laminated veneer lumber (LVL). A composite of wood veneer sheet elements with wood fibers primarily oriented along the length of the member.

Parallel strand lumber (PSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member.

STRUCTURAL GLUED-LAMINATED TIMBER. An engineered, stress-rated product of a timber laminating plant, comprised of assemblies of specially selected and prepared wood laminations in which the grain of all laminations is approximately parallel longitudinally and the laminations are bonded with adhesives.

SUBDIAPHRAGM. A portion of a larger wood diaphragm designed to anchor and transfer local forces to primary diaphragm struts and the main diaphragm.

TIE-DOWN (HOLD-DOWN). A device used to resist uplift of the chords of shear walls.

TREATED WOOD. Wood impregnated under pressure with compounds that reduce its susceptibility to flame spread or to deterioration caused by fungi, insects or marine borers.

WOOD SHEAR PANEL. A wood floor, roof or wall component sheathed to act as a shear wall or diaphragm.

WOOD STRUCTURAL PANEL. A panel manufactured from veneers, wood strands or wafers or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are:

Composite panels. A wood structural panel that is comprised of wood veneer and reconstituted wood-based material and bonded together with waterproof adhesive;

Oriented strand board (OSB). A mat-formed wood structural panel comprised of thin rectangular wood strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive; or

Plywood. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

SECTION 2303
MINIMUM STANDARDS AND QUALITY

2303.1 General. Structural sawn lumber; end-jointed lumber; prefabricated wood I-joists; structural glued-laminated timber; wood structural panels, fiberboard sheathing (when used structurally); hardboard siding (when used structurally); particleboard; preservative-treated wood; structural log members; structural composite lumber; round timber poles and piles; fire-retardant-treated wood; hardwood plywood; wood trusses; joist hangers; nails; and staples shall conform to the applicable provisions of this section.

2303.1.1 Sawn lumber. Sawn lumber used for load-supporting purposes, including end-jointed or edge-glued lumber, machine stress-rated or machine-evaluated lumber, shall be identified by the grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20 or equivalent. Grading practices and identification shall comply with rules published by an agency approved in accordance with the procedures of DOC PS 20 or equivalent procedures. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section is permitted to be accepted for precut, remanufactured or rough-sawn lumber and for sizes larger than 3 inches (76 mm) nominal thickness.

Approved end-jointed lumber is permitted to be used interchangeably with solid-sawn members of the same species and grade.

2303.1.2 Prefabricated wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D 5055.

2303.1.3 Structural glued-laminated timber. Glued-laminated timbers shall be manufactured and identified as required in AITC A190.1 and ASTM D 3737.

2303.1.4 Wood structural panels. Wood structural panels, when used structurally (including those used for siding, roof and wall sheathing, subflooring, diaphragms and built-up members), shall conform to the requirements for their type in DOC PS 1 or PS 2. Each panel or member shall be identified for grade and glue type by the trademarks of an approved testing and grading agency. Wood structural panel components shall be designed and fabricated in accordance with the applicable standards listed in Section 2306.1 and identified by the trademarks of an approved testing and inspection agency indicating conformance with the applica-

ble standard. In addition, wood structural panels when permanently exposed in outdoor applications shall be of exterior type, except that wood structural panel roof sheathing exposed to the outdoors on the underside is permitted to be interior type bonded with exterior glue, Exposure 1.

2303.1.5 Fiberboard. Fiberboard for its various uses shall conform to ASTM C 208. Fiberboard sheathing, when used structurally, shall be identified by an approved agency as conforming to ASTM C 208.

2303.1.5.1 Jointing. To ensure tight-fitting assemblies, edges shall be manufactured with square, shiplapped, beveled, tongue-and-groove or U-shaped joints.

2303.1.5.2 Roof insulation. Where used as roof insulation in all types of construction, fiberboard shall be protected with an approved roof covering.

2303.1.5.3 Wall insulation. Where installed and fireblocked to comply with Chapter 7, fiberboards are permitted as wall insulation in all types of construction. In fire walls and fire barriers, unless treated to comply with Section 803.1 for Class A materials, the boards shall be cemented directly to the concrete, masonry or other noncombustible base and shall be protected with an approved noncombustible veneer anchored to the base without intervening airspaces.

2303.1.5.3.1 Protection. Fiberboard wall insulation applied on the exterior of foundation walls shall be protected below ground level with a bituminous coating.

2303.1.6 Hardboard. Hardboard siding used structurally shall be identified by an approved agency conforming to AHA A135.6. Hardboard underlayment shall meet the strength requirements of $^{7}/_{32}$-inch (5.6 mm) or $^{1}/_{4}$-inch (6.4 mm) service class hardboard planed or sanded on one side to a uniform thickness of not less than 0.200 inch (5.1 mm). Prefinished hardboard paneling shall meet the requirements of AHA A135.5. Other basic hardboard products shall meet the requirements of AHA A135.4. Hardboard products shall be installed in accordance with manufacturer's recommendations.

2303.1.7 Particleboard. Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade mark or certificate of inspection issued by an approved agency. Particleboard shall not be utilized for applications other than indicated in this section unless the particleboard complies with the provisions of Section 2306.4.3.

2303.1.7.1 Floor underlayment. Particleboard floor underlayment shall conform to Type PBU of ANSI A208.1. Type PBU underlayment shall not be less than $^{1}/_{4}$-inch (6.4 mm) thick and shall be installed in accordance with the instructions of the Composite Panel Association.

2303.1.8 Preservative-treated wood. Lumber, timber, plywood, piles and poles supporting permanent structures required by Section 2304.11 to be preservative treated shall conform to the requirements of the applicable AWPA Standard U1 and M4 for the species, product, preservative and end use. Preservatives shall be listed in Section 4 of AWPA U1. Lumber and plywood used in wood foundation systems shall conform to Chapter 18.

2303.1.8.1 Identification. Wood required by Section 2304.11 to be preservative treated shall bear the quality mark of an inspection agency that maintains continuing supervision, testing and inspection over the quality of the preservative-treated wood. Inspection agencies for preservative-treated wood shall be listed by an accreditation body that complies with the requirements of the American Lumber Standards Treated Wood Program, or equivalent. The quality mark shall be on a stamp or label affixed to the preservative-treated wood, and shall include the following information:

1. Identification of treating manufacturer.
2. Type of preservative used.
3. Minimum preservative retention (pcf).
4. End use for which the product is treated.
5. AWPA standard to which the product was treated.
6. Identity of the accredited inspection agency.

2303.1.8.2 Moisture content. Where preservative-treated wood is used in enclosed locations where drying in service cannot readily occur, such wood shall be at a moisture content of 19 percent or less before being covered with insulation, interior wall finish, floor covering or other materials.

2303.1.9 Structural composite lumber. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D 5456.

2303.1.10 Structural log members. Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D 3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section shall be permitted.

2303.1.11 Round timber poles and piles. Round timber poles and piles shall comply with ASTM D 3200 and ASTM D 25, respectively

2303.2 Fire-retardant-treated wood. Fire-retardant-treated wood is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E 84, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test.

2303.2.1 Labeling. Fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain the following items:

1. The identification mark of an approved agency in accordance with Section 1703.5.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread and smoke-developed index.
6. Method of drying after treatment.
7. Conformance with appropriate standards in accordance with Sections 2303.2.2 through 2303.2.5.
8. For fire-retardant-treated wood exposed to weather, damp or wet locations, include the words "No increase in the listed classification when subjected to the Standard Rain Test" (ASTM D 2898).

2303.2.2 Strength adjustments. Design values for untreated lumber and wood structural panels, as specified in Section 2303.1, shall be adjusted for fire-retardant-treated wood. Adjustments to design values shall be based on an approved method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

2303.2.2.1 Wood structural panels. The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D 5516. The test data developed by ASTM D 5516 shall be used to develop adjustment factors, maximum loads and spans, or both, for untreated plywood design values in accordance with ASTM D 6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for its treatment.

2303.2.2.2 Lumber. For each species of wood that is treated, the effects of the treatment, the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D 5664. The test data developed by ASTM D 5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D 6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80°F (27°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

2303.2.3 Exposure to weather, damp or wet locations. Where fire-retardant-treated wood is exposed to weather, or damp or wet locations, it shall be identified as "Exterior" to indicate there is no increase in the listed flame spread index as defined in Section 2303.2 when subjected to ASTM D 2898.

2303.2.4 Interior applications. Interior fire-retardant-treated wood shall have moisture content of not over 28 percent when tested in accordance with ASTM D 3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section 2303.2.2.1 or 2303.2.2.2. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

2303.2.5 Moisture content. Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT), the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in Section 2303.2.2.1 for plywood and 2303.2.2.2 for lumber.

2303.2.6 Type I and II construction applications. See Section 603.1 for limitations on the use of fire-retardant-treated wood in buildings of Type I or II construction.

2303.3 Hardwood and plywood. Hardwood and decorative plywood shall be manufactured and identified as required in HPVA HP-1.

2303.4 Trusses.

2303.4.1 Design. Wood trusses shall be designed in accordance with the provisions of this code and accepted engineering practice. Members are permitted to be joined by nails, glue, bolts, timber connectors, metal connector plates or other approved framing devices.

2303.4.1.1 Truss designer. The individual or organization responsible for the design of trusses.

2303.4.1.2 Truss design drawings. The written, graphic and pictorial **depiction** of each individual truss shall be provided to the building official and approved prior to installation. Truss design drawings shall also be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the information specified below:

1. Slope or depth, span and spacing;
2. Location of joints;
3. Required bearing widths;
4. Design loads as applicable;
5. Top chord live load;
6. Top chord dead load;
7. Bottom chord live load;
8. Bottom chord dead load;
9. Concentrated loads and their points of application as applicable;
10. Controlling wind loads as applicable;
11. Adjustments to lumber and metal connector plate design value for conditions of use;
12. Each reaction force and direction;
13. Metal connector plate type, size, thickness or gage, and the dimensioned location of each metal connector plate except where symmetrically located relative to the joint interface;

14. Lumber size, species and grade for each member;
15. Connection requirements for:
    15.1. Truss to truss;
    15.2. Truss ply to ply; and
    15.3. Field splices.
16. Calculated deflection ratio and maximum vertical and horizontal deflection for live and total load as applicable;
17. Maximum axial tension and compression forces in the truss members; and
18. Required permanent individual truss member bracing and method per Section 2303.4.1.5, unless a specific truss member permanent bracing plan for the roof or floor structural system is provided by a registered design professional.

Where required by one of the following, each individual truss design drawing shall bear the seal and signature of the truss designer:

1. Registered design professional; or
2. Building official; or
3. Statutes of the jurisdiction in which the project is to be constructed.

Exceptions:

1. When a cover sheet/truss index sheet combined into a single cover sheet is attached to the set of truss design drawings for the project, the single sheet/truss index sheet is the only document that needs to be signed and sealed within the truss submittal package.
2. When a cover sheet and a truss index sheet are separately provided and attached to the set of truss design drawings for the project, both the cover sheet and the truss index sheet are the only documents that need to be signed and sealed within the truss submittal package.

2303.4.1.3 Truss placement diagram. The truss manufacturer shall provide a truss placement diagram that identifies the proposed location for each individually designated truss and references the corresponding truss design drawing. The truss placement diagram shall be provided as part of the truss submittal package, and with the shipment of trusses delivered to the job site. Truss placement diagrams shall not be required to bear the seal or signature of the truss designer.

Exception: When the truss placement diagram is prepared under the direct supervision of a registered design professional, it is required to be signed and sealed.

2303.4.1.4 Truss submittal package. The truss submittal package shall consist of each individual truss design drawing, the truss placement diagram for the project, the truss member permanent bracing specification and, as applicable, the cover sheet/truss index sheet.

2303.4.1.5 Truss member permanent bracing. Where permanent bracing of truss members is required on the truss design drawings, it shall be accomplished by one of the following methods:

1. The trusses shall be designed so that the buckling of any individual truss member can be resisted internally by the structure (e.g. buckling member T-bracing, L-bracing, etc.) of the individual truss. The truss individual member buckling reinforcement shall be installed as shown on the truss design drawing or on supplemental truss member buckling reinforcement diagrams provided by the truss designer.
2. Permanent bracing shall be installed using standard industry bracing details that conform with generally accepted engineering practice. Individual truss member continuous lateral bracing location(s) shall be shown on the truss design drawing.

2303.4.1.6 Anchorage. All transfer of loads and anchorage of each truss to the supporting structure is the responsibility of the registered design professional.

2303.4.1.7 Alterations to trusses. Truss members and components shall not be cut, notched, drilled, spliced or otherwise altered in any way without written concurrence and approval of a registered design professional. Alterations resulting in the addition of loads to any member (e.g., HVAC equipment, water heater) shall not be permitted without verification that the truss is capable of supporting such additional loading.

2303.4.2 Metal-plate-connected trusses. In addition to Sections 2303.4.1 through 2303.4.1.7, the design, manufacture and quality assurance of metal-plate-connected wood trusses shall be in accordance with TPI 1. Manufactured trusses shall comply with Section 1704.6 as applicable.

2303.5 Test standard for joist hangers and connectors. For the required test standards for joist hangers and connectors, see Section 1715.1.

2303.6 Nails and staples. Nails and staples shall conform to requirements of ASTM F 1667. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as follows: 80 kips per square inch (ksi) (551 MPa) for shank diameters larger than 0.177 inch (4.50 mm) but not larger than 0.254 inch (6.45 mm), 90 ksi (620 MPa) for shank diameters larger than 0.142 inch (3.61 mm) but not larger than 0.177 inch (4.50 mm) and 100 ksi (689 MPa) for shank diameters of at least 0.099 inch (2.51 mm) but not larger than 0.142 inch (3.61 mm).

2303.7 Shrinkage. Consideration shall be given in design to the possible effect of cross-grain dimensional changes considered vertically which may occur in lumber fabricated in a green condition.

SECTION 2304
GENERAL CONSTRUCTION REQUIREMENTS

2304.1 General. The provisions of this section apply to design methods specified in Section 2301.2.

2304.2 Size of structural members. Computations to determine the required sizes of members shall be based on the net dimensions (actual sizes) and not nominal sizes.

2304.3 Wall framing. The framing of exterior and interior walls shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

2304.3.1 Bottom plates. Studs shall have full bearing on a 2-inch-thick (actual $1^1/_2$-inch, 38 mm) or larger plate or sill having a width at least equal to the width of the studs.

2304.3.2 Framing over openings. Headers, double joists, trusses or other approved assemblies that are of adequate size to transfer loads to the vertical members shall be provided over window and door openings in load-bearing walls and partitions.

2304.3.3 Shrinkage. Wood walls and bearing partitions shall not support more than two floors and a roof unless an analysis satisfactory to the building official shows that shrinkage of the wood framing will not have adverse effects on the structure or any plumbing, electrical or mechanical systems, or other equipment installed therein due to excessive shrinkage or differential movements caused by shrinkage. The analysis shall also show that the roof drainage system and the foregoing systems or equipment will not be adversely affected or, as an alternate, such systems shall be designed to accommodate the differential shrinkage or movements.

2304.3.4 Gable endwalls.

2304.3.4.1 General. Gable endwalls shall be structurally continuous between points of lateral support.

2304.3.4.2 Cathedral endwalls. Gable endwalls adjacent to cathedral ceilings shall be structurally continuous from the uppermost floor to the ceiling diaphragm or to the roof diaphragm.

2304.3.4.3 Full height studs. Full height studs may be sized using the bracing at a ceiling diaphragm for determining stud length requirements.

2304.4 Floor and roof framing. The framing of wood-joisted floors and wood framed roofs shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

2304.5 Framing around flues and chimneys. Combustible framing shall be a minimum of 2 inches (51 mm), but shall not be less than the distance specified in Sections 2111 and 2113 and the *Florida Building Code, Mechanical*, from flues, chimneys and fireplaces, and 6 inches (152 mm) away from flue openings.

2304.6 Wall sheathing. Except as provided for in Section 1405 for weatherboarding or where stucco construction that complies with Section 2510 is installed, enclosed buildings shall be sheathed with one of the materials of the nominal thickness specified in Table 2304.6 or any other approved material of equivalent strength or durability.

2304.6.1 Wood structural panel sheathing. Where wood structural panel sheathing is used as the exposed finish on the exterior of outside walls, it shall have an exterior exposure durability classification. Where wood structural panel sheathing is used on the exterior of outside walls but not as the exposed finish, it shall be of a type manufactured with exterior glue (Exposure 1 or Exterior). Where wood structural panel sheathing is used elsewhere, it shall be of a type manufactured with intermediate or exterior glue.

2304.6.2 Interior paneling. Softwood wood structural panels used for interior paneling shall conform with the provisions of Chapter 8 and shall be installed in accordance with Table 2304.9.1. Panels shall comply with DOC PS 1 or PS 2. Prefinished hardboard paneling shall meet the requirements of AHA A135.5. Hardwood plywood shall conform to HPVA HP-1.

2304.7 Floor and roof sheathing.

2304.7.1 Structural floor sheathing. Structural floor sheathing shall be designed in accordance with the general provisions of this code and the special provisions in this section.

Floor sheathing conforming to the provisions of Table 2304.7(1), 2304.7(2), 2304.7(3) or 2304.7(4) shall be deemed to meet the requirements of this section.

2304.7.2 Structural roof sheathing. Structural roof sheathing shall be designed in accordance with the general provisions of this code and the special provisions in this section.

Roof sheathing conforming to the provisions of Table 2304.7(1), 2304.7(2), 2304.7(3) or 2304.7(5) shall be

TABLE 2304.6
MINIMUM THICKNESS OF WALL SHEATHING

SHEATHING TYPE	MINIMUM THICKNESS	MAXIMUM WALL STUD SPACING
Wood boards	$^5/_8$ inch	24 inches on center
Fiberboard	$^1/_2$ inch	16 inches on center
Wood structural panel	In accordance with Tables 2308.9.3(2) and 2308.9.3(3)	—
M-S "Exterior Glue" and M-2 "Exterior Glue" Particleboard	In accordance with Tables 2306.4.3 and 2308.9.3(4)	—
Gypsum sheathing	$^1/_2$ inch	16 inches on center
Gypsum wallboard	$^1/_2$ inch	24 inches on center
Reinforced cement mortar	1 inch	24 inches on center

For SI: 1 inch = 25.4 mm.

deemed to meet the requirements of this section. Wood structural panel roof sheathing shall be bonded by exterior glue.

2304.8 Lumber decking.

2304.8.1 General. Lumber decking shall be designed and installed in accordance with the general provisions of this code and the provisions of this section. Each piece shall be square-end trimmed. When random lengths are furnished, each piece shall be square-end trimmed across the face so that at least 90 percent of the pieces will be within 0.5 degrees (0.00873 rad) of square. The ends of the pieces shall be permitted to be beveled up to 2 degrees (0.0349 rad) from vertical with the exposed face of the piece slightly longer than the back of the piece. Tongue-and-groove decking shall be installed with the tongues up on sloped or pitched roofs with pattern faces down.

2304.8.2 Layup patterns. Lumber decking is permitted to be laid up following one of five standard patterns as defined in Sections 2304.8.2.1 through 2304.8.2.5. Other patterns are permitted to be used if justified by engineering analysis.

2304.8.2.1 Simple span pattern. All pieces shall be supported by two supports.

2304.8.2.2 Two-span continuous pattern. All pieces shall be supported by three supports, and all end joints shall occur in line on every other support. Supporting members shall be designed to accommodate the load redistribution caused by this pattern.

2304.8.2.3 Combination simple and two-span continuous pattern. Courses in end spans shall be alternating simple span and two span continuous. End joints are staggered in adjacent courses and occur only over supports.

2304.8.2.4 Cantilevered pieces intermixed pattern. The decking shall cover a minimum of three spans. Pieces in the starter course and every third course shall be simple span. Pieces in other courses shall be cantilevered over the supports with end joints at alternate quarter or third points of the spans, and each piece shall bear on at least one support.

2304.8.2.5 Controlled random pattern. The decking shall cover a minimum of three spans. End joints within 6 inches (152 mm) of being in line in either direction shall be separated by at least two intervening courses. In the end bays each piece shall bear on at least one support. Where an end joint occurs in an end bay, the next piece in the same course shall continue over the first inner support for at least 24 inches (610 mm). The details of the controlled random pattern shall be as described for each decking material in Section 2304.8.3.3, 2304.8.4.3 or 2304.8.5.3.

For cantilevered spans with the controlled random pattern, special considerations shall be made when the overhang exceeds 18 inches (457 mm), 24 inches (610 mm) or 36 inches (914 mm) for 2-inch (51 mm), 3-inch (76 mm) or 4-inch (102 mm) nominal thickness decking, respectively. The maximum cantilevered length for the controlled random pattern shall be 30 percent of the length of the first adjacent interior span. For cantilever overhangs within these limits, a structural fascia shall be fastened to each decking piece to maintain a continuous, straight roof line. There shall be no end joints in the can-

TABLE 2304.7(1)
ALLOWABLE SPANS FOR LUMBER FLOOR AND ROOF SHEATHING[a,b]

SPAN (inches)	MINIMUM NET THICKNESS (inches) OF LUMBER PLACED			
	Perpendicular to supports		Diagonally to supports	
	Surfaced dry[c]	Surfaced unseasoned	Surfaced dry[c]	Surfaced unseasoned
Floors				
24	3/4	25/32	3/4	25/32
16	5/8	11/16	5/8	11/16
Roofs				
24	5/8	11/16	3/4	25/32

For SI: 1 inch = 25.4 mm.

a. Installation details shall conform to Sections 2304.7.1 and 2304.7.2 for floor and roof sheathing, respectively.

b. Floor or roof sheathing conforming with this table shall be deemed to meet the design criteria of Section 2304.7.

c. Maximum 19-percent moisture content.

TABLE 2304.7(2)
SHEATHING LUMBER, MINIMUM GRADE REQUIREMENTS: BOARD GRADE

SOLID FLOOR OR ROOF SHEATHING	SPACED ROOF SHEATHING	GRADING RULES
Utility	Standard	NLGA, WCLIB, WWPA
4 common or utility	3 common or standard	NLGA, WCLIB, WWPA, NSLB or NELMA
No. 3	No. 2	SPIB
Merchantable	Construction common	RIS

TABLE 2304.7(3)
ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANEL SHEATHING AND SINGLE-FLOOR GRADES CONTINUOUS OVER TWO OR MORE SPANS WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS[a,b]

SHEATHING GRADES		ROOF[c]				FLOOR[d]
Panel span rating roof/floor span	Panel thickness (inches)	Maximum span (inches)		Load[e] (psf)		Maximum span (inches)
		With edge support[f]	Without edge support	Total load	Live load	
12/0	5/16	12	12	40	30	0
16/0	5/16, 3/8	16	16	40	30	0
20/0	5/16, 3/8	20	20	40	30	0
24/0	3/8, 7/16, 1/2	24	20[g]	40	30	0
24/16	7/16, 1/2	24	24	50	40	16
32/16	15/32, 1/2, 5/8	32	28	40	30	16[h]
40/20	19/32, 5/8, 3/4, 7/8	40	32	40	30	20[h,i]
48/24	23/32, 3/4, 7/8	48	36	45	35	24
54/32	7/8, 1	54	40	45	35	32
60/32	7/8, 1 1/8	60	48	45	35	32
SINGLE FLOOR GRADES		**ROOF[c]**				**FLOOR[d]**
Panel span rating	Panel thickness (inches)	Maximum span (inches)		Load[e] (psf)		Maximum span (inches)
		With edge support[f]	Without edge support	Total load	Live load	
16 o.c.	1/2, 19/32, 5/8	24	24	50	40	16[h]
20 o.c.	19/32, 5/8, 3/4	32	32	40	30	20[h,i]
24 o.c.	23/32, 3/4	48	36	35	25	24
32 o.c.	7/8, 1	48	40	50	40	32
48 o.c.	1 3/32, 1 1/8	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Applies to panels 24 inches or wider.

b. Floor and roof sheathing conforming with this table shall be deemed to meet the design criteria of Section 2304.7.

c. Uniform load deflection limitations 1/180 of span under live load plus dead load, 1/240 under live load only.

d. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking unless 1/4-inch minimum thickness underlayment or 1 1/2 inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is 3/4-inch wood strip. Allowable uniform load based on deflection of 1/360 of span is 100 pounds per square foot except the span rating of 48 inches on center is based on a total load of 65 pounds per square foot.

e. Allowable load at maximum span.

f. Tongue-and-groove edges, panel edge clips (one midway between each support, except two equally spaced between supports 48 inches on center), lumber blocking or other. Only lumber blocking shall satisfy blocked diaphragm requirements.

g. For 1/2-inch panel, maximum span shall be 24 inches.

h. Span is permitted to be 24 inches on center where 3/4-inch wood strip flooring is installed at right angles to joist.

i. Span is permitted to be 24 inches on center for floors where 1 1/2 inches of cellular or lightweight concrete is applied over the panels.

tilevered portion or within one-half of the first adjacent interior span.

2304.8.3 Mechanically laminated decking.

2304.8.3.1 General. Mechanically laminated decking consists of square-edged dimension lumber laminations set on edge and nailed to the adjacent pieces and to the supports.

2304.8.3.2 Nailing. The length of nails connecting laminations shall not be less than two and one-half times the net thickness of each lamination. Where deck supports are 48 inches (1219 mm) on center (o.c.) or less, side nails shall be spaced not more than 30 inches (762 mm) o.c. alternately near top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) o.c., side nails shall be spaced not more than 18 inches (457 mm) o.c. alternately near top and bottom edges and staggered one-third of the spacing in adjacent laminations. Two side nails shall be used at each end of butt-jointed pieces.

Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) o.c. or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) o.c., alternate laminations shall be toenailed to every support.

2304.8.3.3 Controlled random pattern. There shall be a minimum distance of 24 inches (610 mm) between end

TABLE 2304.7(4)
ALLOWABLE SPAN FOR WOOD STRUCTURAL PANEL COMBINATION SUBFLOOR-UNDERLAYMENT (SINGLE FLOOR)[a,b]
(Panels Continuous Over Two or More Spans and Strength Axis Perpendicular to Supports)

IDENTIFICATION	MAXIMUM SPACING OF JOISTS (inches)				
	16	20	24	32	48
Species group[c]	Thickness (inches)				
1	1/2	5/8	3/4	—	—
2, 3	5/8	3/4	7/8	—	—
4	3/4	7/8	1	—	—
Single floor span rating[d]	16 o.c.	20 o.c.	24 o.c.	32 o.c.	48 o.c.

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Spans limited to value shown because of possible effects of concentrated loads. Allowable uniform loads based on deflection of $^1/_{360}$ of span is 100 pounds per square foot except allowable total uniform load for 1 $^1/_8$-inch wood structural panels over joists spaced 48 inches on center is 65 pounds per square foot. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless $^1/_4$-inch minimum thickness underlayment or 1 $^1/_2$ inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is $^3/_4$-inch wood strip.

b. Floor panels conforming with this table shall be deemed to meet the design criteria of Section 2304.7.

c. Applicable to all grades of sanded exterior-type plywood. See DOC PS 1 for plywood species groups.

d. Applicable to Underlayment grade, C-C (Plugged) plywood, and Single Floor grade wood structural panels.

TABLE 2304.7(5)
ALLOWABLE LOAD (PSF) FOR WOOD STRUCTURAL PANEL ROOF SHEATHING CONTINUOUS OVER TWO OR MORE SPANS AND STRENGTH AXIS PARALLEL TO SUPPORTS
(Plywood Structural Panels Are Five-Ply, Five-Layer Unless Otherwise Noted)[a,b]

PANEL GRADE	THICKNESS (inch)	MAXIMUM SPAN (inches)	LOAD AT MAXIMUM SPAN (psf)	
			Live	Total
Structural I sheathing	7/16	24	20	30
	15/32	24	35[c]	45[c]
	1/2	24	40[c]	50[c]
	19/32, 5/8	24	70	80
	23/32, 3/4	24	90	100
Sheathing, other grades covered in DOC PS 1 or DOC PS 2	7/16	16	40	50
	15/32	24	20	25
	1/2	24	25	30
	19/32	24	40[c]	50[c]
	5/8	24	45[c]	55[c]
	23/32, 3/4	24	60[c]	65[c]

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Roof sheathing conforming with this table shall be deemed to meet the design criteria of Section 2304.7.

b. Uniform load deflection limitations $^1/_{180}$ of span under live load plus dead load, $^1/_{240}$ under live load only. Edges shall be blocked with lumber or other approved type of edge supports.

c. For composite and four-ply plywood structural panel, load shall be reduced by 15 pounds per square foot.

joints in adjacent courses. The pieces in the first and second courses shall bear on at least two supports with end joints in these two courses occurring on alternate supports. A maximum of seven intervening courses shall be permitted before this pattern is repeated.

2304.8.4 Two-inch sawn tongue-and-groove decking.

2304.8.4.1 General. Two-inch (51 mm) decking shall have a maximum moisture content of 15 percent. Decking shall be machined with a single tongue-and-groove pattern. Each deck piece shall be nailed to each support as required.

2304.8.4.2 Nailing. Each piece of decking shall be toenailed at each support with one 16d common nail through the tongue and face-nailed with one 16d common nail.

2304.8.4.3 Controlled random pattern. There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on at least two supports with end joints in these two courses occurring on alternate supports. A maximum of seven intervening courses shall be permitted before this pattern is repeated.

2304.8.5 Three- and 4-inch sawn tongue-and-groove decking.

2304.8.5.1 General. Three-inch (76 mm) and 4-inch (102 mm) decking shall have a maximum moisture content of 19 percent. Decking shall be machined with a double tongue-and-groove pattern. Deck pieces shall be interconnected and fastened to the supports as required.

2304.8.5.2 Nailing. Each piece shall be toenailed at each support with one 40d common nail and face-nailed with one 60d common nail. Courses shall be spiked to each other with 8-inch (203 mm) spikes at intervals not to exceed 30 inches (762 mm) through predrilled edge holes penetrating to a depth of approximately 4 inches (102 mm) and with one spike at a distance not exceeding 10 inches (254 mm) from the end of each piece.

2304.8.5.3 Controlled random pattern. There shall be a minimum distance of 48 inches (1219 mm) between end joints in adjacent courses. Pieces not bearing over a support are permitted to occur in interior bays, provided the adjacent pieces in the same course continue over the support for at least 24 inches (610 mm). This condition shall not occur more than once in every six courses in each interior bay.

2304.9 Connections and fasteners.

2304.9.1 Fastener requirements. Connections for wood members shall be designed in accordance with the appropriate methodology in Section 2301.2. The number and size of fasteners connecting wood members shall not be less than that set forth in Table 2304.9.1.

2304.9.2 Sheathing fasteners. Sheathing nails or other approved sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing.

2304.9.3 Joist hangers and framing anchors. Connections depending on joist hangers or framing anchors, ties and other mechanical fastenings not otherwise covered are permitted where approved. The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with Section 1715.1.

2304.9.4 Other fasteners. Clips, staples, glues and other approved methods of fastening are permitted where approved.

2304.9.5 Fasteners in preservative-treated and fire-retardant-treated wood. Fasteners for preservative-treated and fire-retardant-treated wood shall be in accordance with Section 2304.9.5.1 through 2304.9.5.4.

2304.9.5.1 Fasteners for preservative-treated wood. Fasteners for preservative-treated wood shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A 153.

Exception: Fasteners other than nails and timber rivets shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.

2304.9.5.2 Fastenings for wood foundations. Fastenings for wood foundations shall be as required in AF&PA Technical Report No. 7.

2304.9.5.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations. Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Fasteners other than nails, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B 695, Class 55 minimum.

2304.9.5.4 Fasteners for fire-retardant-treated wood used in interior applications. Fasteners for fire-retardant-treated wood used in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations Section 2304.9.5.3 shall apply.

2304.9.6 Load path. Where wall framing members are not continuous from foundation sill to roof, the members shall be secured to ensure a continuous load path. Where required, sheet metal clamps, ties or clips shall be formed of galvanized steel or other approved corrosion-resistant material not less than 0.040 inch (1.01 mm) nominal thickness.

2304.9.7 Framing requirements. Wood columns and posts shall be framed to provide full end bearing. Alternatively, column-and-post end connections shall be designed to resist the full compressive loads, neglecting end-bearing capacity. Column-and-post end connections shall be fastened to resist lateral and net induced uplift forces.

2304.10 Heavy timber construction.

TABLE 2304.9.1
FASTENING SCHEDULE

CONNECTION	FASTENING[a,m]	LOCATION
1. Joist to sill or girder	3 - 8d common ($2^1/_2$″ × 0.131″) 3 - 3″ × 0.131″ nails 3 - 3″ 14 gage staples	toenail
2. Bridging to joist	2 - 8d common ($2^1/_2$″ × 0.131″) 2 - 3″ × 0.131″ nails 2 - 3″ 14 gage staples	toenail each end
3. 1″ × 6″ subfloor or less to each joist	2 - 8d common ($2^1/_2$″ × 0.131″)	face nail
4. Wider than 1″ × 6″ subfloor to each joist	3 - 8d common ($2^1/_2$″ × 0.131″)	face nail
5. 2″ subfloor to joist or girder	2 - 16d common ($3^1/_2$″ × 0.162″)	blind and face nail
6. Sole plate to joist or blocking	16d ($3^1/_2$″ × 0.135″) at 16″ o.c. 3″ × 0.131″ nails at 8″ o.c. 3″ 14 gage staples at 12″ o.c.	typical face nail
Sole plate to joist or blocking at braced wall panel	3″ - 16d ($3^1/_2$″ × 0.135″) at 16″ 4 - 3″ × 0.131″ nails at 16″ 4 - 3″ 14 gage staples per 16″	braced wall panels
7. Top plate to stud	2 - 16d common ($3^1/_2$″ × 0.162″) 3 - 3″ × 0.131″ nails 3 - 3″ 14 gage staples	end nail
8. Stud to sole plate	4 - 8d common ($2^1/_2$″ × 0.131″) 4 - 3″ × 0.131″ nails 3 - 3″ 14 gage staples	toenail
	2 - 16d common ($3^1/_2$″ × 0.162″) 3 - 3″ × 0.131″ nails 3 - 3″ 14 gage staples	end nail
9. Double studs	16d ($3^1/_2$″ × 0.135″) at 24″ o.c. 3″ × 0.131″ nail at 8″ o.c. 3″ 14 gage staple at 8″ o.c.	face nail
10. Double top plates	16d ($3^1/_2$″ × 0.135″) at 16″ o.c. 3″ × 0.131″ nail at 12″ o.c. 3″ 14 gage staple at 12″ o.c.	typical face nail
Double top plates	8-16d common ($3^1/_2$″ × 0.162″) 12-3″ × 0.131″ nails 12-3″ 14 gage staples	lap splice
11. Blocking between joists or rafters to top plate	3 - 8d common ($2^1/_2$″ × 0.131″) 3 - 3″ × 0.131″ nails 3 - 3″ 14 gage staples	toenail
12. Rim joist to top plate	8d ($2^1/_2$″ × 0.131″) at 6″ o.c. 3″ × 0.131″ nail at 6″ o.c. 3″ 14 gage staple at 6″ o.c.	toenail
13. Top plates, laps and intersections	2 - 16d common ($3^1/_2$″ × 0.162″) 3 - 3″ × 0.131″ nails 3 -3″ 14 gage staples	face nail
14. Continuous header, two pieces	16d common ($3^1/_2$″ × 0.162″)	16″ o.c. along edge
15. Ceiling joists to plate	3 - 8d common ($2^1/_2$″ × 0.131″) 5 - 3″ × 0.131″ nails 5 - 3″ 14 gage staples	toenail
16. Continuous header to stud	4 - 8d common ($2^1/_2$″ × 0.131″)	toenail

(continued)

TABLE 2304.9.1—continued
FASTENING SCHEDULE

CONNECTION	FASTENING[a,m]	LOCATION
17. Ceiling joists, laps over partitions (see Section 2308.10.4.1, Table 2308.10.4.1)	3 - 16d common ($3^1/_2$" × 0.162") minimum, Table 2308.10.4.1 4 - 3" × 0.131" nails 4 - 3" 14 gage staples	face nail
18. Ceiling joists to parallel rafters (see Section 2308.10.4.1, Table 2308.10.4.1)	3 - 16d common ($3^1/_2$" × 0.162") minimum, Table 2308.10.4.1 4 - 3" × 0.131" nails 4 - 3" 14 gage staples	face nail
19. Rafter to plate (see Section 2308.10.1, Table 2308.10.1)	3 - 8d common ($2^1/_2$" × 0.131") 3 - 3" × 0.131" nails 3 - 3" 14 gage staples	toenail
20. 1" diagonal brace to each stud and plate	2 - 8d common ($2^1/_2$" × 0.131") 2 - 3" × 0.131" nails 3 - 3" 14 gage staples	face nail
21. 1" × 8" sheathing to each bearing	3 - 8d common ($2^1/_2$" × 0.131")	face nail
22. Wider than 1" × 8" sheathing to each bearing	3 - 8d common ($2^1/_2$" × 0.131")	face nail
23. Built-up corner studs	16d common ($3^1/_2$" × 0.162") 3" × 0.131" nails 3" 14 gage staples	24" o.c. 16" o.c. 16" o.c.
24. Built-up girder and beams	20d common (4" × 0.192") 32" o.c. 3" × 0.131" nail at 24" o.c. 3" 14 gage staple at 24" o.c. 2 - 20d common (4" × 0.192") 3 - 3" × 0.131" nails 3 - 3" 14 gage staples	face nail at top and bottom staggered on opposite sides face nail at ends and at each splice
25. 2" planks	16d common ($3^1/_2$" × 0.162")	at each bearing
26. Collar tie to rafter	3 - 10d common (3" × 0.148") 4 - 3" x 0.131" nails 4 - 3" 14 gage staples	face nail
27. Jack rafter to hip	3 - 10d common (3" x 0.148") 4 - 3" × 0.131" nails 4 - 3" 14 gage staples 2 - 16d common ($3^1/_2$" × 0.162") 3 -3" × 0.131" nails 3 - 3" 14 gage staples	toenail face nail
28. Roof rafter to 2-by ridge beam	2 - 16d common ($3^1/_2$" × 0.162") 3 - 3" × 0.131" nails 3 - 3" 14 gage staples 2-16d common ($3^1/_2$" × 0.162") 3 - 3" × 0.131" nails 3 - 3" 14 gage staples	toenail face nail
29. Joist to band joist	3 - 16d common ($3^1/_2$" × 0.162") 4 - 3" × 0.131" nails 4 - 3" 14 gage staples	face nail

(continued)

TABLE 2304.9.1—continued
FASTENING SCHEDULE

CONNECTION	FASTENING[a,m]		LOCATION
30. Ledger strip	3 - 16d common ($3^1/_2$" × 0.162") 4 - 3" x 0.131" nails 4 - 3" 14 gage staples		face nail
31. Wood structural panels and particleboard[b] Subfloor, roof and wall sheathing (to framing)	$^1/_2$" and less	6d[c,l] $2\ ^3/_8$" × 0.113" nail[n] $1\ ^3/_4$" 16 gage[o]	6 inch o.c. edges and intermediate, 4 inch o.c. at component and cladding edge strip #3 [refer to Figure 6-3 of ASCE 7]
	$^{15}/_{32}$" in to $^{19}/_{32}$"	8d common (roofs in 110-140 mph (Exp. B)	
	$^{19}/_{32}$" to $^3/_4$"	8d[d] or 6d[e] $2\ ^3/_8$" × 0.113" nail[p]	
	$^7/_8$" to 1"	2" 16 gage[p] 8d[c]	
Single Floor (combination subfloor-underlayment to framing)	$1\ ^1/_8$" to $1\ ^1/_4$"	10d[d] or 8d[d]	
	$^3/_4$" and less	6d[e]	
	$^7/_8$" to 1"	8d[e]	
	$1\ ^1/_8$" to $1\ ^1/_4$"	10d[d] or 8d[e]	
32. Panel siding (to framing)	$^1/_2$" or less	6d[f]	
	$^5/_8$"	8d[f]	
33. Fiberboard sheathing[g]	$^1/_2$"	No. 11 gage roofing nail[h] 6d common nail (2" × 0.113") No. 16 gage staple[i]	
	$^{25}/_{32}$"	No. 11 gage roofing nail[h] 8d common nail ($2^1/_2$" × 0.131") No. 16 gage staple[i]	
34. Interior paneling	$^1/_4$"	4d[j]	
	$^3/_8$"	6d[k]	

For SI: 1 inch = 25.4 mm.

a. Common or box nails are permitted to be used except where otherwise stated.

b. Nails spaced at 6 inches on center at edges, 12 inches at intermediate supports except 6 inches at supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.

c. Common or deformed shank (6d - 2" × 0.113"; 8d - $2^1/_2$" × 0.131"; 10d - 3" × 0.148").

d. Common (6d - 2" × 0.113"; 8d - $2^1/_2$" × 0.131"; 10d - 3" × 0.148").

e. Deformed shank (6d - 2" × 0.113"; 8d - $2^1/_2$" × 0.131"; 10d - 3" × 0.148").

f. Corrosion-resistant siding (6d - $1^7/_8$" × 0.106"; 8d - $2^3/_8$" × 0.128") or casing (6d - 2" × 0.099"; 8d - $2^1/_2$" × 0.113") nail.

g. Fasteners spaced 3 inches on center at exterior edges and 6 inches on center at intermediate supports, when used as structural sheathing. Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications.

h. Corrosion-resistant roofing nails with $^7/_{16}$-inch-diameter head and $1^1/_2$-inch length for $^1/_2$-inch sheathing and $1\ ^3/_4$-inch length for $^{25}/_{32}$-inch sheathing.

i. Corrosion-resistant staples with nominal $^7/_{16}$-inch crown and $1\ ^1/_8$-inch length for $^1/_2$-inch sheathing and $1\ ^1/_2$-inch length for $^{25}/_{32}$-inch sheathing. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).

j. Casing ($1^1/_2$" × 0.080") or finish ($1^1/_2$" × 0.072") nails spaced 6 inches on panel edges, 12 inches at intermediate supports.

k. Panel supports at 24 inches. Casing or finish nails spaced 6 inches on panel edges, 12 inches at intermediate supports.

l. For roof sheathing applications, 8d nails ($2^1/_2$" × 0.113") are the minimum required for wood structural panels.

m. Staples shall have a minimum crown width of $^7/_{16}$ inch.

n. For roof sheathing applications, fasteners spaced 4 inches on center at edges, 8 inches at intermediate supports.

o. Fasteners spaced 4 inches on center at edges, 8 inches at intermediate supports for subfloor and wall sheathing and 3 inches on center at edges, 6 inches at intermediate supports for roof sheathing.

p. Fasteners spaced 4 inches on center at edges, 8 inches at intermediate supports.

2304.10.1 Columns. Columns shall be continuous or superimposed throughout all stories by means of reinforced concrete or metal caps with brackets, or shall be connected by properly designed steel or iron caps, with pintles and base plates, or by timber splice plates affixed to the columns by metal connectors housed within the contact faces, or by other approved methods.

2304.10.1.1 Column connections. Girders and beams shall be closely fitted around columns and adjoining ends shall be cross tied to each other, or intertied by caps or ties, to transfer horizontal loads across joints. Wood bolsters shall not be placed on tops of columns unless the columns support roof loads only.

2304.10.2 Floor framing. Approved wall plate boxes or hangers shall be provided where wood beams, girders or trusses rest on masonry or concrete walls. Where intermediate beams are used to support a floor, they shall rest on top of girders, or shall be supported by ledgers or blocks securely fastened to the sides of the girders, or they shall be supported by an approved metal hanger into which the ends of the beams shall be closely fitted.

2304.10.3 Roof framing. Every roof girder and at least every alternate roof beam shall be anchored to its supporting member; and every monitor and every sawtooth construction shall be anchored to the main roof construction. Such anchors shall consist of steel or iron bolts of sufficient strength to resist vertical uplift of the roof.

2304.10.4 Floor decks. Floor decks and covering shall not extend closer than $^1/_2$ inch (12.7 mm) to walls. Such $^1/_2$-inch (12.7 mm) spaces shall be covered by a molding fastened to the wall either above or below the floor and arranged such that the molding will not obstruct the expansion or contraction movements of the floor. Corbeling of masonry walls under floors is permitted in place of such molding.

2304.10.5 Roof decks. Where supported by a wall, roof decks shall be anchored to walls to resist uplift forces determined in accordance with Chapter 16. Such anchors shall consist of steel or iron bolts of sufficient strength to resist vertical uplift of the roof.

2304.11 Protection against decay and termites.

2304.11.1 General. Where required by this section, protection from decay and termites shall be provided by the use of naturally durable or preservative-treated wood.

2304.11.2 Wood used above ground. Wood used above ground in the locations specified in Sections 2304.11.2.1 through 2304.11.2.7, 2304.11.3 and 2304.11.5 shall be naturally durable wood or preservative-treated wood using water-borne preservatives, in accordance with AWPA U1 (Commodity Specifications A or F) for above-ground use.

2304.11.2.1 Joists, girders and subfloor. Where wood joists or the bottom of a wood structural floor without joists are closer than 18 inches (457 mm), or wood girders are closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation, the floor assembly (including posts, girders, joists and subfloor) shall be of naturally durable or preservative-treated wood.

2304.11.2.2 Wood supported by exterior foundation walls. Wood framing members, including wood sheathing, that rest on exterior foundation walls and are less than 8 inches (203 mm) from exposed earth shall be of naturally durable or preservative-treated wood. Wood framing members and furring strips attached directly to masonry or concrete walls shall be of approved naturally durable or preservative-treated wood.

2304.11.2.3 Exterior walls below grade. Wood framing members and furring strips attached directly to the interior of exterior masonry or concrete walls below grade shall be of approved naturally durable or preservative-treated wood.

2304.11.2.4 Sleepers and sills. Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of naturally durable or preservative-treated wood.

2304.11.2.5 Girder ends. The ends of wood girders entering exterior masonry or concrete walls shall be provided with a $^1/_2$-inch (12.7 mm) air space on top, sides and end, unless naturally durable or preservative-treated wood is used.

2304.11.2.6 Wood siding. Clearance between wood siding and earth on the exterior of a building shall not be less than 6 inches (152 mm) except where siding, sheathing and wall framing are of naturally durable or preservative-treated wood.

2304.11.2.7 Posts or columns. Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be of naturally durable or preservative-treated wood.

Exceptions:

1. Posts or columns that are either exposed to the weather or located in basements or cellars, supported by concrete piers or metal pedestals projected at least 1 inch (25 mm) above the slab or deck and 6 inches (152 mm) above exposed earth, and are separated therefrom by an impervious moisture barrier.
2. Posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building, supported by a concrete pier or metal pedestal at a height greater than 8 inches (203 mm) from exposed ground, and are separated therefrom by an impervious moisture barrier.

2304.11.3 Laminated timbers. The portions of glued-laminated timbers that form the structural supports of a building or other structure and are exposed to weather and not fully protected from moisture by a roof, eave or similar covering shall be pressure treated with preservative or be manufactured from naturally durable or preservative-treated wood.

2304.11.4 Wood in contact with the ground or fresh water. Wood used in contact with the ground (exposed earth) in the

locations specified in Sections 2304.11.4.1 and 2304.11.4.2 shall be naturally durable (species for both decay and termite resistance) or preservative treated using water-borne preservatives in accordance with AWPA U1 (Commodity Specifications A or F) for soil or fresh water use.

Exception: Untreated wood is permitted where such wood is continuously and entirely below the ground-water level or submerged in fresh water.

2304.11.4.1 Posts or columns. Posts and columns supporting permanent structures that are embedded in concrete that is in direct contact with the earth, embedded in concrete that is exposed to the weather or in direct contact with the earth shall be of preservative-treated wood.

2304.11.4.2 Wood structural members. Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood unless separated from such floors or roofs by an impervious moisture barrier.

2304.11.4.3 Decks, fences, patios, planters or other wooden building components that directly abut the sidewall of the foundation or structure shall be constructed so as to provide:

1. Eighteen-inch (457 mm) clearance beneath, or
2. Six-inch (152 mm) clearance between the top of the component and the exterior wall covering or
3. have components that are easily removable by screws or hinges to allow access for inspection of the foundation sidewall and treatment for termites.

2304.11.5 Supporting member for permanent appurtenances. Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering to prevent moisture or water accumulation on the surface or at joints between members.

Exception: When a building is located in a geographical region where experience has demonstrated that climatic conditions preclude the need to use durable materials where the structure is exposed to the weather.

2304.11.6 Termite protection. Termite protection shall be provided by floor framing of naturally durable or preservative-treated wood, soil treatment or other approved methods of termite protection.

2304.11.7 Wood used in retaining walls and cribs. Wood installed in retaining or crib walls shall be preservative treated in accordance with AWPA U1 (Commodity Specifications A or F) for soil and fresh water use.

2304.11.8 Attic ventilation. For attic ventilation, see Section 1203.2.

2304.11.9 Under-floor ventilation (crawl space). For under-floor ventilation (crawl space), see Section 1203.3.

2304.11.10 Foam-plastic insulation.

2304.11.10.1 The provisions of Section 2603.8 shall apply to the installation of foam plastic insulation in close proximity to the ground.

Exception: Materials which are of naturally durable wood or are pressure treated for ground contact, and which are installed with at least 6 inches (152 mm) clear space from the structure to allow for inspection and treatment for termites.

In order to reduce chances of termite infestation, no wood, vegetation, stumps, dead roots, cardboard, trash or other cellulose-containing material shall be buried on the building lot within 15 feet (4.6 m) of any building or the position of any building proposed to be built.

2304.12 Long-term loading. Wood members supporting concrete, masonry or similar materials shall be checked for the effects of long-term loading using the provisions of the AF&PA NDS. The total deflection, including the effects of long-term loading, shall be limited in accordance with Section 1604.3.1 for these supported materials.

Exception: Horizontal wood members supporting masonry or concrete nonstructural floor or roof surfacing not more than 4 inches (102 mm) thick need not be checked for long-term loading.

2304.13 Preparation of building site and removal of debris.

2304.13.1 All building sites shall be graded to provide drainage under all portions of the building not occupied by basements.

2304.13.2 The foundation and the area encompassed within 1 foot (305 mm) therein shall have all vegetation, stumps, dead roots, cardboard, trash and foreign material removed and the fill material shall be free of vegetation and foreign material. The fill shall be compacted to assure adequate support of the foundation.

2304.13.3 After all work is completed, loose wood and debris shall be completely removed from under the building and within 1 foot (305 mm) thereof. All wood forms and supports shall be completely removed. This includes, but is not limited to: wooden grade stakes, forms, contraction spacers, tub trap boxes, plumbing supports, bracing, shoring, forms or other cellulose-containing material placed in any location where such materials are not clearly visible and readily removable prior to completion of the work. Wood shall not be stored in contact with the ground under any building.

SECTION 2305
GENERAL DESIGN REQUIREMENTS FOR LATERAL-FORCE-RESISTING SYSTEMS

2305.1 General. Structures using wood shear walls and diaphragms to resist wind, and other lateral loads shall be designed and constructed in accordance with the provisions of this section. Alternatively, compliance with the AF&PA SDPWS shall be permitted subject to the limitations therein and the limitations of this code.

2305.1.1 Shear resistance based on principles of mechanics. Shear resistance of diaphragms and shear walls are permitted to be calculated by principles of mechanics using values of fastener strength and sheathing shear resistance.

2305.1.2 Framing. Boundary elements shall be provided to transmit tension and compression forces. Perimeter members at openings shall be provided and shall be detailed to distribute the shearing stresses. Diaphragm and shear wall sheathing shall not be used to splice boundary elements. Diaphragm chords and collectors shall be placed in, or tangent to, the plane of the diaphragm framing unless it can be demonstrated that the moments, shears and deformations, considering eccentricities resulting from other configurations can be tolerated without exceeding the adjusted resistance and drift limits.

2305.1.2.1 Framing members. Framing members shall be at least 2 inch (51 mm) nominal width. In general, adjoining panel edges shall bear and be attached to the framing members and butt along their centerlines. Nails shall be placed not less than $^3/_8$ inch (9.5 mm) from the panel edge, not more than 12 inches (305 mm) apart along intermediate supports, and 6 inches (152 mm) along panel edge bearings, and shall be firmly driven into the framing members.

2305.1.3 Openings in shear panels. Openings in shear panels that materially affect their strength shall be fully detailed on the plans, and shall have their edges adequately reinforced to transfer all shearing stresses.

2305.1.4 Shear panel connections. Positive connections and anchorages, capable of resisting the design forces, shall be provided between the shear panel and the attached components.

2305.1.5 Wood members resisting horizontal seismic forces contributed by masonry and concrete walls. Reserved.

2305.1.6 Wood members resisting seismic forces from nonstructural concrete or masonry. Reserved.

2305.2 Design of wood diaphragms.

2305.2.1 General. Wood diaphragms are permitted to be used to resist horizontal forces provided the deflection in the plane of the diaphragm, as determined by calculations, tests or analogies drawn therefrom, does not exceed the permissible deflection of attached distributing or resisting elements. Connections shall extend into the diaphragm a sufficient distance to develop the force transferred into the diaphragm.

2305.2.2 Deflection. Permissible deflection shall be that deflection up to which the diaphragm and any attached distributing or resisting element will maintain its structural integrity under design load conditions, such that the resisting element will continue to support design loads without danger to occupants of the structure. Calculations for diaphragm deflection shall account for the usual bending and shear components as well as any other factors, such as nail deformation, which will contribute to deflection.

The deflection (Δ) of a blocked wood structural panel diaphragm uniformly nailed throughout is permitted to be calculated by using the following equation. If not uniformly nailed, the constant 0.188 (For SI: $^1/_{1627}$) in the third term must be modified accordingly.

$$\Delta = \frac{5vL^3}{8EAb} + \frac{vL}{4Gt} + 0.188Le_n + \frac{\Sigma(\Delta_c X)}{2b} \quad \textbf{(Equation 23-1)}$$

$$\text{For SI: } \Delta = \frac{0.052vL^3}{EAb} + \frac{vL}{4Gt} + \frac{Le_n}{1627} + \frac{\Sigma(\Delta_c X)}{2b}$$

where:

A = Area of chord cross section, in square inches (mm^2).

b = Diaphragm width, in feet (mm).

E = Elastic modulus of chords, in pounds per square inch (N/mm^2).

e_n = Nail or staple deformation, in inches (mm) [see Table 2305.2.2(1)].

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth [see Table 2305.2.2(2)].

L = Diaphragm length, in feet (mm).

v = Maximum shear due to design loads in the direction under consideration, in pounds per linear foot (plf) (N/mm).

Δ = The calculated deflection, in inches (mm).

TABLE 2305.2.2(1)
e_n VALUES (inches) FOR USE IN CALCULATING DIAPHRAGM DEFLECTION DUE TO FASTENER SLIP (Structural I)[a,d]

LOAD PER FASTENER[c] (pounds)	FASTENER DESIGNATIONS[b]			
	6d	8d	10d	14-Ga staple x 2 inches long
60	0.01	0.00	0.00	0.011
80	0.02	0.01	0.01	0.018
100	0.03	0.01	0.01	0.028
120	0.04	0.02	0.01	0.04
140	0.06	0.03	0.02	0.053
160	0.10	0.04	0.02	0.068
180	—	0.05	0.03	—
200	—	0.07	0.47	—
220	—	0.09	0.06	—
240	—	—	0.07	—

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N.

a. Increase e_n values 20 percent for plywood grades other than Structural I.

b. Nail values apply to common wire nails or staples identified.

c. Load per fastener = maximum shear per foot divided by the number of fasteners per foot at interior panel edges.

d. Decrease e_n values 50 percent for seasoned lumber (moisture content < 19 percent).

TABLE 2305.2.2(2)
VALUES OF *Gt* FOR USE IN CALCULATING DEFLECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS AND DIAPHRAGMS

PANEL TYPE	SPAN RATING	VALUES OF *Gt* (lb/in. panel depth or width)							
		OTHER				STRUCTURAL I			
		3-ply Plywood	4-ply Plywood	5-ply Plywood[a]	OSB	3-ply Plywood	4-ply Plywood	5-ply Plywood[a]	OSB
Sheathing	24/0	25,000	32,500	37,500	77,500	32,500	42,500	41,500	77,500
	24/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	32/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	40/20	28,500	37,000	43,000	88,500	37,000	48,000	47,500	88,500
	48/24	31,000	40,500	46,500	96,000	40,500	52,500	51,000	96,000
Single Floor	16 o.c.	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	20 o.c.	28,000	36,500	42,000	87,000	36,500	47,500	46,000	87,000
	24 o.c.	30,000	39,000	45,000	93,000	39,000	50,500	49,500	93,000
	32 o.c.	36,000	47,000	54,000	110,000	47,000	61,000	59,500	110,000
	48 o.c.	50,500	65,500	76,000	155,000	65,500	85,000	83,500	155,000

		OTHER			STRUCTURAL I		
	Thickness (in.)	A-A, A-C	Marine	All Other Grades	A-A, A-C	Marine	All Other Grades
Sanded Plywood	1/4	24,000	31,000	24,000	31,000	31,000	31,000
	11/32	25,500	33,000	25,500	33,000	33,000	33,000
	3/8	26,000	34,000	26,000	34,000	34,000	34,000
	15/32	38,000	49,500	38,000	49,500	49,500	49,500
	1/2	38,500	50,000	38,500	50,000	50,000	50,000
	19/32	49,000	63,500	49,000	63,500	63,500	63,500
	5/8	49,500	64,500	49,500	64,500	64,500	64,500
	23/32	50,500	65,500	50,500	65,500	65,500	65,500
	3/4	51,000	66,500	51,000	66,500	66,500	66,500
	7/8	52,500	68,500	52,500	68,500	68,500	68,500
	1	73,500	95,500	73,500	95,500	95,500	95,500
	1 1/8	75,000	97,500	75,000	97,500	97,500	97,500

For SI: 1 inch = 25.4 mm, 1 pound/inch = 0.1751 N/mm.

a. Applies to plywood with five or more layers; for five-ply/three-layer plywood, use values for four ply.

$\Sigma(\Delta_c X)$= Sum of individual chord-splice slip values on both sides of the diaphragm, each multiplied by its distance to the nearest support.

2305.2.3 Diaphragm aspect ratios. Size and shape of diaphragms shall be limited as set forth in Table 2305.2.3.

TABLE 2305.2.3
MAXIMUM DIAPHRAGM DIMENSION RATIOS
HORIZONTAL AND SLOPED DIAPHRAGM

TYPE	MAXIMUM LENGTH - WIDTH RATIO
Wood structural panel, nailed all edges	4:1
Wood structural panel, blocking omitted at intermediate joints	3:1
Diagonal sheathing, single	3:1
Diagonal sheathing, double	4:1

2305.2.4 Construction. Wood diaphragms shall be constructed of wood structural panels manufactured with exterior glue and not less than 4 feet by 8 feet (1219 mm by 2438 mm), except at boundaries and changes in framing where minimum sheet dimension shall be 24 inches (610 mm) unless all edges of the undersized sheets are supported by and fastened to framing members or blocking. Wood structural panel thickness for horizontal diaphragms shall not be less than the valves set forth in Tables 2304.7(3), 2304.7(4) and 2304.7(5) for corresponding joist spacing and loads.

2305.2.4.1 Seismic Design Category F. Reserved.

2305.2.5 Rigid diaphragms. Design of structures with rigid diaphragms shall conform to the structure configuration requirements of Section 12.3.2 of ASCE 7 and the horizontal shear distribution requirements of Section 12.8.4 of ASCE 7.

Open-front structures with rigid wood diaphragms resulting in torsional force distribution are permitted, provided the length, *l*, of the diaphragm normal to the open side does not exceed 25 feet (7620 mm), the diaphragm sheathing conforms to Section 2305.2.4 and the *l*/*w* ratio [as shown in Figure 2305.2.5(1)] is less than 1 for one-story structures or 0.67 for structures over one story in height.

Exception: Where calculations show that diaphragm deflections can be tolerated, the length, *l*, normal to the open end is permitted to be increased to a *l*/*w* ratio not greater than 1.5 where sheathed in compliance with Section 2305.2.4 or to 1 where sheathed in compliance with Section 2306.3.4 or 2306.3.5.

Rigid wood diaphragms are permitted to cantilever past the outermost supporting shearwall (or other vertical resisting element) a length, *l*, of not more than 25 feet (7620 mm) or two-thirds of the diaphragm width, *w*, whichever is smaller. Figure 2305.2.5(2) illustrates the dimensions of *l* and *w* for a cantilevered diaphragm.

2305.3 Design of wood shear walls.

2305.3.1 General. Wood shear walls are permitted to resist horizontal forces in vertical distributing or resisting elements, provided the deflection in the plane of the shearwall, as determined by calculations, tests or analogies drawn therefrom, does not exceed the more restrictive of the permissible deflection of attached distributing or resisting elements.

2305.3.2 Deflection. Permissible deflection shall be that deflection up to which the shear wall and any attached distributing or resisting element will maintain its structural integrity under design load conditions, i.e., continue to support design loads without danger to occupants of the structure.

The deflection (Δ) of a blocked wood structural panel shear wall uniformly fastened throughout is permitted to be calculated by the use of the following equation:

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a\frac{h}{b} \qquad \textbf{(Equation 23-2)}$$

For SI: $\Delta = \frac{vh^3}{3EAb} + \frac{vh}{Gt} + \frac{he_n}{407.6} + d_a\frac{h}{b}$

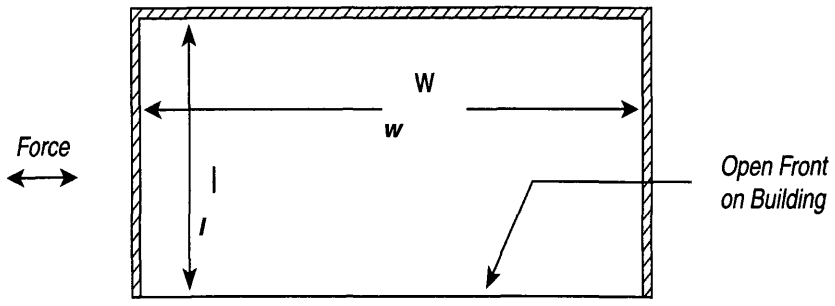


FIGURE 2305.2.5(1)
DIAPHRAGM LENGTH AND WIDTH FOR PLAN VIEW OF OPEN-FRONT BUILDING

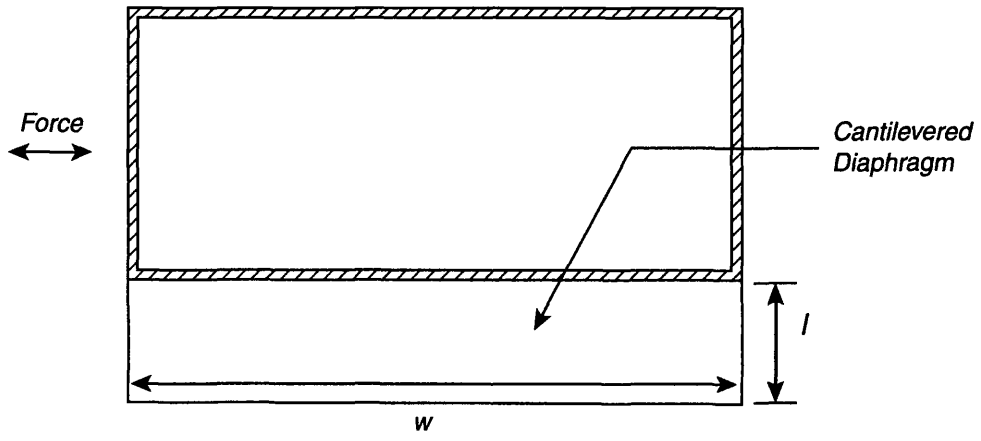


FIGURE 2305.2.5(2)
DIAPHRAGM LENGTH AND WIDTH FOR PLAN VIEW OF CANTILEVERED DIAPHRAGM

where:

A = Area of boundary element cross section in square inches (mm^2) (vertical member at shear wall boundary).

b = Wall width, in feet (mm).

d_a = Vertical elongation of overturning anchorage (including fastener slip, device elongation, anchor rod elongation, etc.) at the design shear load (v).

E = Elastic modulus of boundary element (vertical member at shear wall boundary), in pounds per square inch (N/mm^2).

e_n = Nail or staple deformation, in inches (mm) [see Table 2305.2.2(1)].

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth [see Table 2305.2.2(2)].

h = Wall height, in feet (mm).

v = Maximum shear due to design loads at the top of the wall, in pounds per linear foot (N/mm).

Δ = The calculated deflection, in inches (mm).

2305.3.3 Construction. Wood shear walls shall be constructed of wood structural panels manufactured with exterior glue and not less than 4 feet by 8 feet (1219 mm by 2438 mm), except at boundaries and at changes in framing. All edges of all panels shall be supported by and fastened to framing members or blocking. Wood structural panel thickness for shear walls shall not be less than set forth in Table 2304.6.1 for corresponding framing spacing and loads, except that $^1/_4$ inch (6.4 mm) is permitted to be used where perpendicular loads permit.

TABLE 2305.3.4
MAXIMUM SHEAR WALL DIMENSION RATIOS

TYPE	MAXIMUM HEIGHT-WIDTH RATIO
Wood structural panels or particleboard, nailed edges	$3^1/_2$:1
Diagonal sheathing, single	2:1
Fiberboard	$1^1/_2$:1
Gypsum board, gypsum lath, cement plaster	$1^1/_2$:1[b]

a. Reserved.

b. Ratio shown is for unblocked construction. Height-to-width ratio is permitted to be 2:1 where the wall is installed as blocked construction in accordance with Section 2306.4.5.1.2.

2305.3.4 Shear wall aspect ratios. Size and shape of shear walls, perforated shear wall segments within perforated shear walls and wall piers within shear walls that are designed for force transfer around openings shall be limited as set forth in Table 2305.3.4. The height, h, and the width, w, shall be determined in accordance with Sections 2305.3.5 through 2305.3.5.2 and 2305.3.6 through 2305.3.6.2, respectively.

2305.3.5 Shear wall height definition. The height of a shear wall, h, shall be defined as:

1. The maximum clear height from the top of the foundation to the bottom of the diaphragm framing above; or
2. The maximum clear height from the top of the diaphragm to the bottom of the diaphragm framing above [see Figure 2305.3.5(a)].

2305.3.5.1 Perforated shear wall segment height definition. The height of a perforated shear wall segment, h, shall be defined as specified in Section 2305.3.5 for shear walls.

2305.3.5.2 Force transfer shear wall pier height definition. The height, h, of a wall pier in a shear wall with openings designed for force transfer around openings

shall be defined as the clear height of the pier at the side of an opening [see Figure 2305.3.5(b)].

2305.3.6 Shear wall width definition. The width of a shear wall, *w*, shall be defined as the sheathed dimension of the shear wall in the direction of application of force [see Figure 2305.3.5(a)].

2305.3.6.1 Perforated shear wall segment width definition. The width of a perforated shear wall segment, *w*, shall be defined as the width of full-height sheathing adjacent to openings in the perforated shear wall [see Figure 2305.3.5(a)].

2305.3.6.2 Force transfer shear wall pier width definition. The width, *w*, of a wall pier in a shear wall with openings designed for force transfer around openings shall be defined as the sheathed width of the pier at the side of an opening [see Figure 2305.3.5(b)].

2305.3.7 Overturning restraint. Where the dead load stabilizing moment in accordance with Chapter 16 allowable stress design load combinations is not sufficient to prevent uplift due to overturning moments on the wall, an anchoring device shall be provided. Anchoring devices shall maintain a continuous load path to the foundation.

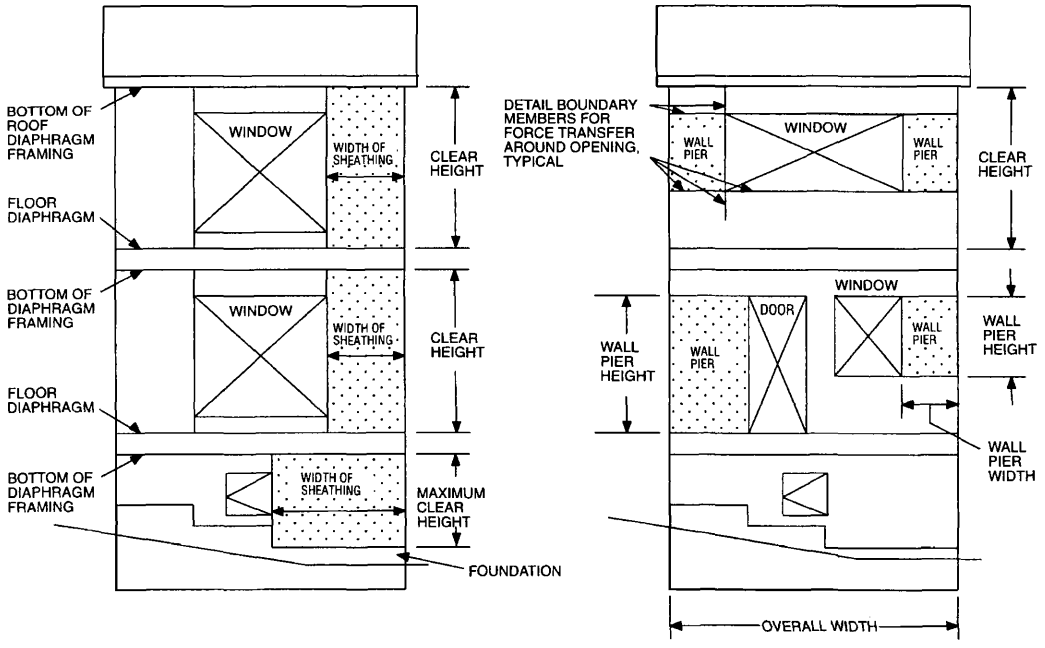
2305.3.8 Shear walls with openings. The provisions of this section shall apply to the design of shear walls with openings. Where framing and connections around the openings are designed for force transfer around the openings, the provisions of Section 2305.3.8.1 shall apply. Where framing and connections around the openings are not designed for force transfer around the openings, the provisions of Section 2305.3.8.2 shall apply.

2305.3.8.1 Force transfer around openings. Where shear walls with openings are designed for force transfer around the openings, the limitations of Table 2305.3.4 shall apply to the overall shear wall, including openings, and to each wall pier at the side of an opening. Design for force transfer shall be based on a rational analysis. Detailing of boundary elements around the opening shall be provided in accordance with the provisions of this section[see Figure 2305.3.5(b)].

2305.3.8.2 Perforated shear walls. The provisions of Section 2305.3.8.2 shall be permitted to be used for the design of perforated shear walls. For the determination of the height and width of perforated shear wall segments, see Sections 2305.3.5.1 and 2305.3.6.1, respectively.

2305.3.8.2.1 Limitations. The following limitations shall apply to the use of Section 2305.3.8.2:

1. A perforated shear wall segment shall be located at each end of a perforated shear wall. Openings shall be permitted to occur beyond the ends of the perforated shear wall, provided the width of such openings is not be included in the width of the perforated shear wall.
2. The allowable shear set forth in Table 2306.4.1 shall not exceed 490 plf (7150 N/m).



(a) HEIGHT-TO-WIDTH RATIO FOR SHEAR WALLS AND PERFORATED SHEAR WALLS

(b) HEIGHT-TO-WIDTH RATIO WITH DESIGN FOR FORCE TRANSFER AROUND OPENINGS

FIGURE 2305.3.5
GENERAL DEFINITION OF SHEAR WALL HEIGHT, WIDTH AND HEIGHT-TO-WIDTH RATIO

3. Where out-of-plane offsets occur, portions of the wall on each side of the offset shall be considered as separate perforated shear walls.
4. Collectors for shear transfer shall be provided through the full length of the perforated shear wall.
5. A perforated shear wall shall have uniform top of wall and bottom of wall elevations. Perforated shear walls not having uniform elevations shall be designed by other methods.
6. Perforated shear wall height, *h*, shall not exceed 20 feet (6096 mm).

2305.3.8.2.2 Perforated shear wall resistance. The resistance of a perforated shear wall shall be calculated in accordance with the following:

1. The percentage of full-height sheathing shall be calculated as the sum of the widths of perforated shear wall segments divided by the total width of the perforated shear wall, including openings.
2. The maximum opening height shall be taken as the maximum opening clear height. Where areas above and below an opening remain unsheathed, the height of the opening shall be defined as the height of the wall.
3. The unadjusted shear resistance shall be the allowable shear set forth in Table 2306.4.1 for height-to-width ratios of perforated shear wall segments that do not exceed $3^1/_2$:1
4. The adjusted shear resistance shall be calculated by multiplying the unadjusted shear resistance by the shear resistance adjustment factors of Table 2305.3.8.2. For intermediate percentages of full-height sheathing, the values in Table 2305.3.8.2 are permitted to be interpolated.
5. The perforated shear wall resistance shall be equal to the adjusted shear resistance times the sum of the widths of the perforated shear wall segments.

2305.3.8.2.3 Anchorage and load path. Design of perforated shear wall anchorage and load path shall conform to the requirements of Sections 2305.3.8.2.4 through 2305.3.8.2.8, or shall be calculated using principles of mechanics. Except as modified by these sections, wall framing, sheathing, sheathing attachment and fastener schedules shall conform to the requirements of Section 2305.2.4 and Table 2306.4.1.

2305.3.8.2.4 Uplift anchorage at perforated shear wall ends. Anchorage for uplift forces due to overturning shall be provided at each end of the perforated shear wall. The uplift anchorage shall conform to the requirements of Section 2305.3.7, except that for each story the minimum tension chord uplift force, *T*, shall be calculated in accordance with the following:

$$T = \frac{Vh}{C_o \Sigma L_i} \qquad \textbf{(Equation 23-3)}$$

where:

T = Tension chord uplift force, pounds (N).

V = Shear force in perforated shear wall, pounds (N).

TABLE 2305.3.8.2
SHEAR RESISTANCE ADJUSTMENT FACTOR, C_o

	MAXIMUM OPENING HEIGHT[a]				
WALL HEIGHT, H	H/3	H/2	2H/3	5H/6	H
8′ wall	2′-8″	4′-0″	5′-4″	6′-8″	8′-0″
10′ wall	3′-4″	5′-0″	6′-8″	8′-4″	10′-0″
Percentage of full-height sheathing[b]	Shear resistance adjustment factor				
10%	1.00	0.69	0.53	0.43	0.36
20%	1.00	0.71	0.56	0.45	0.38
30%	1.00	0.74	0.59	0.49	0.42
40%	1.00	0.77	0.63	0.53	0.45
50%	1.00	0.80	0.67	0.57	0.50
60%	1.00	0.83	0.71	0.63	0.56
70%	1.00	0.87	0.77	0.69	0.63
80%	1.00	0.91	0.83	0.77	0.71
90%	1.00	0.95	0.91	0.87	0.83
100%	1.00	1.00	1.00	1.00	1.00

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
a. See Section 2305.3.8.2.2, Item 2.
b. See Section 2305.3.8.2.2, Item 1.

h = Perforated shear wall height, feet (mm).

C_o = Shear resistance adjustment factor from Table 2305.3.8.2.

$\sum L_i$ = Sum of widths of perforated shear wall segments, feet (mm).

2305.3.8.2.5 Anchorage for in-plane shear. The unit shear force, v, transmitted into the top of a perforated shear wall, out of the base of the perforated shear wall at full height sheathing and into collectors connecting shear wall segments shall be calculated in accordance with the following:

$$v = \frac{V}{C_o \Sigma L_i} \qquad \textbf{(Equation 23-4)}$$

where:

v = Unit shear force, pounds per lineal feet (N/m).

V = Shear force in perforated shear wall, pounds (N).

C_o = Shear resistance adjustment factor from Table 2305.3.8.2.

$\sum L_i$ = Sum of widths of perforated shear wall segments, feet (mm).

2305.3.8.2.6 Uplift anchorage between perforated shear wall ends. In addition to the requirements of Section 2305.3.8.2.4, perforated shear wall bottom plates at full-height sheathing shall be anchored for a uniform uplift force, t, equal to the unit shear force, v, determined in Section 2305.3.8.2.5.

2305.3.8.2.7 Compression chords. Each end of each perforated shear wall segment shall be designed for a compression chord force, C, equal to the tension chord uplift force, T, calculated in Section 2305.3.8.2.4.

2305.3.8.2.8 Load path. Load path. A load path to the foundation shall be provided for each uplift force, T and t, for each shear force, V and v, and for each compression chord force, C. Elements resisting shear wall forces contributed by multiple stories shall be designed for the sum of forces contributed by each story.

2305.3.8.2.9 Deflection of shear walls with openings. The controlling deflection of a blocked shear wall with openings uniformly fastened throughout shall be taken as the maximum individual deflection of the shear wall segments calculated in accordance with Section 2305.3.2, divided by the appropriate shear resistance adjustment factors of Table 2305.3.8.2.

2305.3.9 Summing shear capacities. The shear values for shear panels of different capacities applied to the same side of the wall are not cumulative except as allowed in Table 2306.4.1.

The shear values for material of the same type and capacity applied to both faces of the same wall are cumulative. Where the material capacities are not equal, the allowable shear shall be either two times the smaller shear capacity or the capacity of the stronger side, whichever is greater.

Summing shear capacities of dissimilar materials applied to opposite faces or to the same wall line is not allowed.

Exception: For wind design, the allowable shear capacity of shear wall segments sheathed with a combination of wood structural panels and gypsum wallboard on opposite faces, fiberboard structural sheathing and gypsum wallboard on opposite faces or hardboard panel siding and gypsum wallboard on opposite faces shall equal the sum of the sheathing capacities of each face separately.

2305.3.10 Adhesives. Adhesive attachment of shear wall sheathing is not permitted as a substitute for mechanical fasteners, and shall not be used in shear wall strength calculations alone.

2305.3.11 Sill plate size and anchorage in Seismic Design Category D, E or F. Reserved.

SECTION 2306
ALLOWABLE STRESS DESIGN

2306.1 Allowable stress design. The structural analysis and construction of wood elements in structures using allowable stress design shall be in accordance with the following applicable standards:

American Forest & Paper Association.

NDS National Design Specification for Wood Construction

American Institute of Timber Construction.

AITC 104 Typical Construction Details

AITC 110 Standard Appearance Grades for Structural Glued Laminated Timber

AITC 113 Standard for Dimensions of Structural Glued Laminated Timber

AITC 117 Standard Specifications for Structural Glued Laminated Timber of Softwood Species

AITC 119 Structural Standard Specifications for Glued Laminated Timber of Hardwood Species

AITC A190.1 Structural Glued Laminated Timber

AITC 200 Inspection Manual

American Society of Agricultural Engineers.

ASAE EP 484.2 Diaphragm Design of Metal-Clad, Post-Frame Rectangular Buildings

ASAE EP 486.1 Shallow Post Foundation Design

ASAE 559 Design Requirements and Bending Properties for Mechanically Laminated Columns

APA—The Engineered Wood Association.

Panel Design Specification

Plywood Design Specification Supplement 1 - Design & Fabrication of Plywood Curved Panel

Plywood Design Specification Supplement 2 - Design & Fabrication of Glued Plywood-Lumber Beams

Plywood Design Specification Supplement 3 - Design & Fabrication of Plywood Stressed-Skin Panels

Plywood Design Specification Supplement 4 - Design & Fabrication of Plywood Sandwich Panels

Plywood Design Specification Supplement 5 - Design & Fabrication of All-Plywood Beams

EWS T300 Glulam Connection Details

EWS S560 Field Notching and Drilling of Glued Laminated Timber Beams

EWS S475 Glued Laminated Beam Design Tables

EWS X450 Glulam in Residential Construction

EWS X440 Product and Application Guide: Glulam

EWS R540 Builders Tips: Proper Storage and Handling of Glulam Beams

Truss Plate Institute, Inc.

TPI 1 National Design Standard for Metal Plate Connected Wood Truss Construction

2306.1.1 Joists and rafters. The design of rafter spans is permitted to be in accordance with the *AF&PA Span Tables for Joists and Rafters*.

2306.1.2 Plank and beam flooring. The design of plank and beam flooring is permitted to be in accordance with the *AF&PA Wood Construction Data No. 4*.

2306.1.3 Treated wood stress adjustments. The allowable unit stresses for preservative-treated wood need no adjustment for treatment, but are subject to other adjustments.

The allowable unit stresses for fire-retardant-treated wood, including fastener values, shall be developed from an approved method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and the redrying process. Other adjustments are applicable except that the impact load duration shall not apply.

2306.1.4 Lumber decking. The capacity of lumber decking arranged according to the patterns described in Section 2304.8.2 shall be the lesser of the capacities determined for flexure and deflection according to the formulas in Table 2306.1.4.

TABLE 2306.1.4
ALLOWABLE LOADS FOR LUMBER DECKING

PATTERN	ALLOWABLE AREA LOAD[a,b]	
	Flexure	Deflection
Simple span	$\sigma_b = \frac{8F_b' d^2}{l^2 \ 6}$	$\sigma_\Delta = \frac{384\Delta E' d^3}{5l^4 \ 12}$
Two-span continuous	$\sigma_b = \frac{8F_b' d^2}{l^2 \ 6}$	$\sigma_\Delta = \frac{185\Delta E' d^3}{l^4 \ 12}$
Combination simple- and two-span continuous	$\sigma_b = \frac{8F_b' d^2}{l^2 \ 6}$	$\sigma_\Delta = \frac{131\Delta E' d^3}{l^4 \ 12}$
Cantilevered pieces intermixed	$\sigma_b = \frac{20F_b' d^2}{3l^2 \ 6}$	$\sigma_\Delta = \frac{105\Delta E' d^3}{l^4 \ 12}$
Controlled random layup		
Mechanically laminated decking	$\sigma_b = \frac{20F_b' d^2}{3l^2 \ 6}$	$\sigma_\Delta = \frac{100\Delta E' d^3}{l^4 \ 12}$
2-inch decking	$\sigma_b = \frac{20F_b' d^2}{3l^2 \ 6}$	$\sigma_\Delta = \frac{100\Delta E' d^3}{l^4 \ 12}$
3-inch and 4-inch decking	$\sigma_b = \frac{20F_b' d^2}{3l^2 \ 6}$	$\sigma_\Delta = \frac{116\Delta E' d^3}{l^4 \ 12}$

For SI: 1 inch = 25.4 mm.

a. σ_b = Allowable total uniform load limited by bending.
σ_Δ = Allowable total uniform load limited by deflection.

b. d = Actual decking thickness.
l = Span of decking.
F_b' = Allowable bending stress adjusted by applicable factors.
E' = Modulus of elasticity adjusted by applicable factors.

2306.2 Wind provisions for walls.

2306.2.1 Wall stud bending stress increase. The AF&PA NDS fiber stress in bending (F_b) design values for sawn lumber wood studs resisting out of plane wind loads shall be increased by the factors in Table 2306.2.1, in lieu of the 1.15 repetitive member factor. These increases take into consideration the load sharing and composite actions provided by the wood structural panels as defined in Section 2302.1. The increases shall apply where the studs are designed for bending and are spaced no more than 16 inches (406 mm) o.c., covered on the inside with a minimum of $^1/_2$-inch (12.7 mm) gypsum board fastened in accordance with Table 2306.4.5 and sheathed on the exterior with a minimum of $^3/_8$-inch (9.5 mm) wood structural panel sheathing. All panel joints shall occur over studs or blocking and shall be attached using a minimum of 8d common nails spaced a maximum of 6 inches o.c. (152 mm) at panel edges and 12 inches o.c. (305 mm) at intermediate framing members.

TABLE 2306.2.1
WALL STUD BENDING STRESS INCREASE FACTORS

STUD SIZE	SYSTEM FACTOR
2 × 4	1.5
2 × 6	1.35
2 × 8	1.25
2 × 10	1.2
2 × 12	1.15

2306.3 Wood diaphragms.

2306.3.1 Wood structural panel diaphragms. Wood structural panel diaphragms are permitted to resist horizon-

tal forces using the allowable shear capacities set forth in Table 2306.3.1 or 2306.3.2. The allowable shear capacities are permitted to be calculated by principles of mechanics without limitations by using values for fastener strength in the AF&PA NDS, structural design properties for wood structural panels based on DOC PS-1 and DOC PS-2 or wood structural panel design properties given in the *APA Panel Design Specification* (PDS).

2306.3.2 Shear capacities modifications. The allowable shear capacities in Tables 2306.3.1 and 2306.3.2 for horizontal wood structural panel diaphragms shall be increased 40 percent for wind design.

2306.3.3 Diagonally sheathed lumber diaphragms. Diagonally sheathed lumber diaphragms shall be nailed in accordance with Table 2306.3.3.

2306.3.4 Single diagonally sheathed lumber diaphragms. Single diagonally sheathed lumber diaphragms shall be constructed of minimum 1-inch (25 mm) thick nominal sheathing boards laid at an angle of approximately 45 degrees (0.78 rad) to the supports. The shear capacity for single diagonally sheathed lumber diaphragms of southern pine or Douglas fir-larch shall not exceed 300 plf (4378 N/m) of width. The shear capacities shall be adjusted by reduction factors of 0.82 for framing members of species with a specific gravity equal to or greater than 0.42 but less than 0.49 and 0.65 for species with a specific gravity of less than 0.42, as contained in the AF&PA NDS.

2306.3.4.1 End joints. End joints in adjacent boards shall be separated by at least one stud or joist space and there shall be at least two boards between joints on the same support.

2306.3.4.2 Single diagonally sheathed lumber diaphragms. Single diagonally sheathed lumber diaphragms made up of 2-inch (51 mm) nominal diagonal lumber sheathing fastened with 16d nails shall be designed with the same shear capacities as shear panels using 1-inch (25 mm) boards fastened with 8d nails, provided there are not splices in adjacent boards on the same support and the supports are not less than 4 inch (102 mm) nominal depth or 3 inch (76 mm) nominal thickness.

2306.3.5 Double diagonally sheathed lumber diaphragms. Double diagonally sheathed lumber diaphragms shall be constructed of two layers of diagonal sheathing boards at 90 degrees (1.57 rad) to each other on the same face of the supporting members. Each chord shall be considered as a beam with uniform load per foot equal to 50 percent of the unit shear due to diaphragm action. The load shall be assumed as acting normal to the chord in the plan of the diaphragm in either direction. The span of the chord or portion thereof shall be the distance between framing members of the diaphragm, such as the joists, studs and blocking that serve to transfer the assumed load to the sheathing. The shear capacity of double diagonally sheathed diaphragms of Southern pine or Douglas fir-larch shall not exceed 600 plf (8756 kN/m) of width. The shear capacity shall be adjusted by reduction factors of 0.82 for framing members of species with a specific gravity equal to or greater than 0.42 but less than 0.49 and 0.65 for species with a specific gravity of less than 0.42, as contained in the AF&PA NDS. Nailing of diagonally sheathed lumber diaphragms shall be in accordance with Table 2306.3.3.

2306.3.6 Gypsum board diaphragm ceilings. Gypsum board diaphragm ceilings shall be in accordance with Section 2508.5.

2306.4 Shear walls. Panel sheathing joints in shear walls shall occur over studs or blocking. Adjacent panel sheathing joints shall occur over and be nailed to common framing members (see Section 2305.3.1 for limitations on shear wall bracing materials).

2306.4.1 Wood structural panel shear walls. The allowable shear capacities for wood structural panel shear walls shall be in accordance with Table 2306.4.1. These capacities are permitted to be increased 40 percent for wind design. Shear walls are permitted to be calculated by principles of mechanics without limitations by using values for nail strength given in the AF&PA NDS and wood structural

TABLE 2306.3.3
DIAGONALLY SHEATHED LUMBER DIAPHRAGM NAILING SCHEDULE

SHEATHING NOMINAL DIMENSION	NAILING TO INTERMEDIATE AND END-BEARING STUDS		NAILING AT THE SHEAR PANEL BOUNDARIES	
	Type, size and number of nails per board			
	Common nails	Box nails	Common nails	Box nails
1 × 6	2 - 8d	3 - 8d	3 - 8d	5 - 8d
1 × 8	3 - 8d	4 - 8d	4 - 8d	6 - 8d
2 × 6	2 - 16d	3 - 16d	3 - 16d	5 - 16d
2 × 8	3 - 16d	4 - 16d	4 - 16d	6 - 16d

TABLE 2306.3.1
ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS FIR-LARCH, OR SOUTHERN PINE[a] FOR WIND LOADING [h]

PANEL GRADE	COMMON NAIL SIZE OR STAPLE[f] LENGTH AND GAGE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES[g] (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					Fastener spacing (inches) at diaphragm boundaries (all cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5, 6)[b]				Fasteners spaced 6″ max. at supported edges[b]	
					6	4	2 1/2[c]	2[c]		
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4)[b]					
					6	6	4	3	Case 1 (No unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and 6)
Structural I Grades	6d[e] (2″ × 0.113″)	1 1/4	5/16	2	185	250	375	420	165	125
				3	210	280	420	475	185	140
	1 1/2 16 Gage	1		2	155	205	310	350	135	105
				3	175	230	345	390	155	115
	8d (2 1/2″ × 0.131)	1 3/8	3/8	2	270	360	530	600	240	180
				3	300	400	600	675	265	200
	1 1/2 16 Gage	1		2	175	235	350	400	155	115
				3	200	265	395	450	175	130
	10d[d] (3″ × 0.148″)	1 1/2	15/32	2	320	425	640	730	285	215
				3	360	480	720	820	320	240
	1 1/2 16 Gage	1		2	175	235	350	400	155	120
				3	200	265	395	450	175	130
Sheathing, single floor and other grades covered in DOC PS 1 and PS 2	6d[e] (2″ × 0.113)	1 1/4	5/16	2	170	225	335	380	150	110
				3	190	250	380	430	170	125
	1 1/2 16 Gage	1		2	140	185	275	315	125	90
				3	155	205	310	350	140	105
	6d[e] (2″ × 0.113)	1 1/4	3/8	2	185	250	375	420	165	125
				3	210	280	420	475	185	140
	8d (2 1/2″ × 0.131)	1 3/8		2	240	320	480	545	215	160
				3	270	360	540	610	240	180

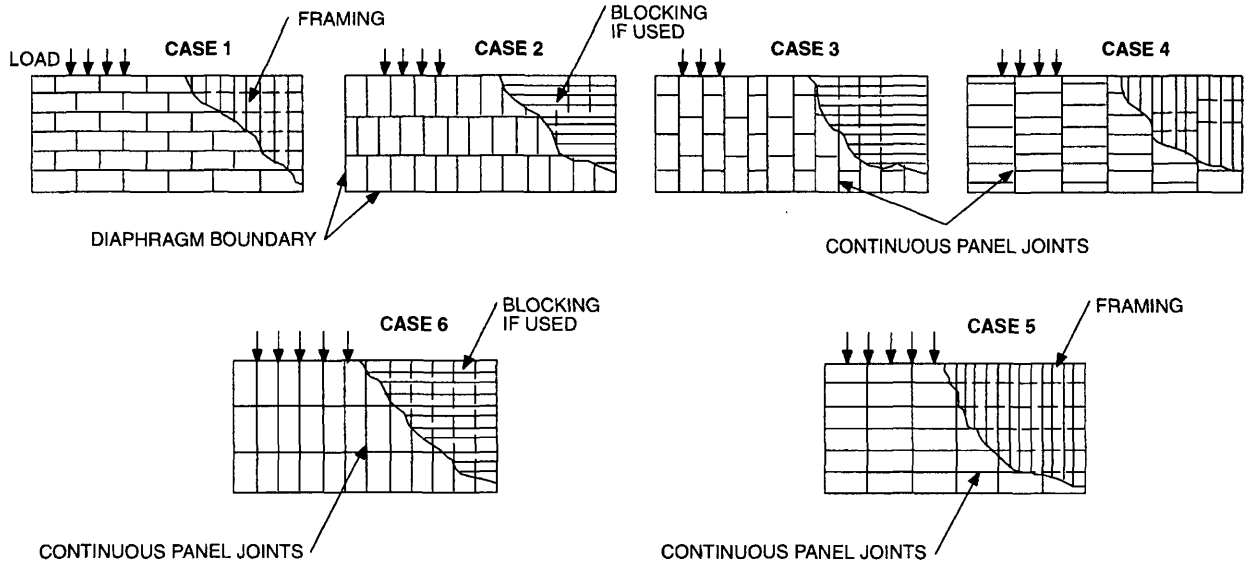
(continued)

TABLE 2306.3.1—continued
ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS FIR-LARCH, OR SOUTHERN PINE[a] FOR WIND LOADING[h]

PANEL GRADE	COMMON NAIL SIZE OR STAPLE[f] LENGTH AND GAGE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES[g] (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					Fastener spacing (inches) at diaphragm boundaries (all cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5, 6)[b]				Fasteners spaced 6" max. at supported edges[b]	
					6	4	2 1/2[c]	2[c]		
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4)[b]					
					6	6	4	3	Case 1 (No unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and 6)
Sheathing, single floor and other grades covered in DOC PS 1 and PS 2 (continued)	1 1/2 16 Gage	1	3/8	2	160	210	315	360	140	105
				3	180	235	355	400	160	120
	8d (2 1/2" × 0.131")	1 3/8	7/16	2	255	340	505	575	230	170
				3	285	380	570	645	255	190
	1 1/2 16 Gage	1		2	165	225	335	380	150	110
				3	190	250	375	425	165	125
	8d (2 1/2" × 0.131")	1 3/8	15/32	2	270	360	530	600	240	180
				3	300	400	600	675	265	200
	10d[d] (3" × 0.148")	1 1/2		2	290	385	575	655	255	190
				3	325	430	650	735	290	215
	1 1/2 16 Gage	1		2	160	210	315	360	140	105
				3	180	235	355	405	160	120
	10d[d] (3" × 0.148")	1 1/2	19/32	2	320	425	640	730	285	215
				3	360	480	720	820	320	240
	1 3/4 16 Gage	1		2	175	235	350	400	155	115
				3	200	265	395	450	175	130

(continued)

TABLE 2306.3.1—continued
ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS FIR-LARCH, OR SOUTHERN PINE[a] FOR WIND LOADING[h]



For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of other species: (1) Find specific gravity for species of lumber in AF&PA NDS. (2) For staples find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species. (3) For nails find shear value from table above for nail size for actual grade and multiply value by the following adjustment factor: Specific Gravity Adjustment Factor = [1-(0.5 - SG)], where SG = Specific Gravity of the framing lumber. This adjustment factor shall not be greater than 1.

b. Space fasteners maximum 12 inches o.c. along intermediate framing members (6 inches o.c. where supports are spaced 48 inches o.c.).

c. Framing at adjoining panel edges shall be 3 inches nominal or wider, and nails shall be staggered where nails are spaced 2 inches o.c. or $2\,^{1}/_{2}$ inches o.c.

d. Framing at adjoining panel edges shall be 3 inches nominal or wider, and nails shall be staggered where both of the following conditions are met: (1) 10d nails having penetration into framing of more than $1\,^{1}/_{2}$ inches and (2) nails are spaced 3 inches o.c. or less.

e. 8d is recommended minimum for roofs due to negative pressures of high winds.

f. Staples shall have a minimum crown width of $^{7}/_{16}$ inch and shall be installed with their crowns parallel to the long dimension of the framing members.

g. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.

h. For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.

TABLE 2306.3.2
ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL BLOCKED DIAPHRAGMS UTILIZING MULTIPLE ROWS OF FASTENERS (HIGH LOAD DIAPHRAGMS) WITH FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE[a] FOR WIND LOADING[b, g, h]

PANEL GRADE[c]	COMMON NAIL SIZE OR STAPLE[f] GAGE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER AT ADJOINING PANEL EDGES AND BOUNDARIES[e]	LINES OF FASTENERS	BLOCKED DIAPHRAGMS					
						Cases 1 and 2[d]					
						Fastener Spacing Per Line at Boundaries (inches)					
						4		$2^1/_2$		2	
						Fastener Spacing Per Line at Other Panel Edges (inches)					
						6	4	4	3	3	2
Structural I grades	10d common nails	$1^1/_2$	$^{15}/_{32}$	3	2	605	815	875	1,150	—	—
				4	2	700	915	1,005	1,290	—	—
				4	3	875	1,220	1,285	1,395	—	—
			$^{19}/_{32}$	3	2	670	880	965	1,255	—	—
				4	2	780	990	1,110	1,440	—	—
				4	3	965	1,320	1,405	1,790	—	—
			$^{23}/_{32}$	3	2	730	955	1,050	1,365	—	—
				4	2	855	1,070	1,210	1,565	—	—
				4	3	1,050	1,430	1,525	1,800	—	—
	14 gage staples	2	$^{15}/_{32}$	3	2	600	600	860	960	1,060	1,200
				4	3	860	900	1,160	1,295	1,295	1,400
			$^{19}/_{32}$	3	2	600	600	875	960	1,075	1,200
				4	3	875	900	1,175	1,440	1,475	1,795
Sheathing single floor and other grades covered in DOC PS 1 and PS 2	10d common nails	$1^1/_2$	$^{15}/_{32}$	3	2	525	725	765	1,010	—	—
				4	2	605	815	875	1,105	—	—
				4	3	765	1,085	1,130	1,195	—	—
			$^{19}/_{32}$	3	2	650	860	935	1,225	—	—
				4	2	755	965	1,080	1,370	—	—
				4	3	935	1,290	1,365	1,485	—	—
			$^{23}/_{32}$	3	2	710	935	1,020	1,335	—	—
				4	2	825	1,050	1,175	1,445	—	—
				4	3	1,020	1,400	1,480	1,565	—	—
	14 gage staples	2	$^{15}/_{32}$	3	2	540	540	735	865	915	1,080
				4	3	735	810	1,005	1,105	1,105	1,195
			$^{19}/_{32}$	3	2	600	600	865	960	1,065	1,200
				4	3	865	900	1,130	1,430	1,370	1,485
			$^{23}/_{32}$	4	3	865	900	1,130	1,490	1,430	1,545

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of other species: (1) Find specific gravity for species of framing lumber in AF&PA NDS. (2) For staples, find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species. (3) For nails, find shear value from table above for nail size of actual grade and multiply value by the following adjustment factor: Specific Gravity Adjustment Factor = [1-(0.5 - SG)], where SG = Specific gravity of the framing lumber. This adjustment factor shall not be greater than 1.

b. Fastening along intermediate framing members: Space fasteners a maximum of 12 inches on center, except 6 inches on center for spans greater than 32 inches.

c. Panels conforming to PS 1 or PS 2.

d. This table gives shear values for Cases 1 and 2 as shown in Table 2306.3.1. The values shown are applicable to Cases 3, 4, 5 and 6 as shown in Table 2306.3.1, providing fasteners at all continuous panel edges are spaced in accordance with the boundary fastener spacing.

e. The minimum nominal depth of framing members shall be 3 inches nominal. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.

f. Staples shall have a minimum crown width of $^7/_{16}$ inch, and shall be installed with their crowns parallel to the long dimension of the framing members.

g. *High load diaphragms shall be subject to special inspection in accordance with Section 1704.6.1.*

h. For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.

panel design properties given in the *APA Panel Design Specification*.

2306.4.2 Lumber sheathed shear walls. Single and double diagonally sheathed lumber diaphragms are permitted using the construction and allowable load provisions of Sections 2306.3.4 and 2306.3.5.

2306.4.3 Particleboard shear walls. The design shear capacity of particleboard shear walls shall be in accordance with Table 2306.4.3. Shear panels shall be constructed with particleboard sheets not less than 4 feet by 8 feet (1219 mm by 2438 mm), except at boundaries and changes in framing. Particleboard panels shall be designed to resist shear only, and chords, collector members and boundary elements shall be connected at all corners. Panel edges shall be backed with 2-inch (51 mm) nominal or wider framing. Sheets are permitted to be installed either horizontally or vertically. For $^3/_8$-inch (9.5 mm) particleboard sheets installed with the long dimension parallel to the studs spaced 24 inches (610 mm) o.c, nails shall be spaced at 6 inches (152 mm) o.c. along intermediate framing members. For all other conditions, nails of the same size shall be spaced at 12 inches (305 mm) o.c. along intermediate framing members. Particleboard panels less than 12 inches (305 mm) wide shall be blocked.

2306.4.4 Fiberboard shear walls. The design shear capacity of fiberboard shear walls shall be in accordance with Table 2306.4.4. The fiberboard sheathing shall be applied vertically or horizontally to wood studs not less than 2 inch (51 mm) nominal thickness spaced 16 inches (406 mm) o.c. Blocking not less than 2 inch (51 mm) nominal in thickness shall be provided at horizontal joints.

2306.4.5 Shear walls sheathed with other materials. Shear capacities for walls sheathed with lath and plaster, and gypsum board shall be in accordance with Table 2306.4.5. Shear walls sheathed with lath, plaster and gypsum board shall be constructed in accordance with Chapter 25 and Section 2306.4.5.1.

2306.4.5.1 Application of gypsum board or lath and plaster to wood framing.

2306.4.5.1.1 Joint staggering. End joints of adjacent courses of gypsum board shall not occur over the same stud.

2306.4.5.1.2 Blocking. Where required in Table 2306.4.5, wood blocking having the same cross-sectional dimensions as the studs shall be provided at joints that are perpendicular to the studs.

2306.4.5.1.3 Fastening. Studs, top and bottom plates and blocking shall be fastened in accordance with Table 2304.9.1.

2306.4.5.1.4 Fasteners. The size and spacing of fasteners shall be set forth in Table 2306.4.5. Fasteners shall be spaced not less than $^3/_8$ inch (9.5 mm) from edges and ends of gypsum boards or sides of studs, blocking and top and bottom plates.

2306.4.5.1.5 Gypsum lath. Gypsum lath shall be applied perpendicular to the studs. Maximum allowable shear values shall be as set forth in Table 2306.4.5.

2306.4.5.1.6 Gypsum sheathing. Four-foot-wide (1219 mm) pieces of gypsum sheathing shall be applied parallel or perpendicular to studs. Two-foot-wide (610 mm) pieces of gypsum sheathing shall be applied perpendicular to the studs. Maximum allowable shear values shall be as set forth in Table 2306.4.5.

2306.4.5.1.7 Other gypsum boards. Gypsum board shall be applied parallel or perpendicular to studs. Maximum allowable shear values shall be as set forth in Table 2306.4.5.

SECTION 2307
LOAD AND RESISTANCE FACTOR DESIGN

2307.1 Load and resistance factor design. The structural analysis and construction of wood elements and structures using load and resistance factor design shall be in accordance with AF&PA NDS.

2307.1.1 Wood structural panel shear walls. Reserved.

SECTION 2308
CONVENTIONAL LIGHT-FRAME CONSTRUCTION

2308.1 General. The requirements of this section are intended for conventional light-frame construction. Other methods are permitted to be used, provided a satisfactory design is submitted showing compliance with other provisions of this code. Interior nonload-bearing partitions, ceilings and curtain walls of conventional light-frame construction are not subject to the limitations of this section. Alternatively, compliance with AF&PA WFCM shall be permitted subject to the limitations therein and the limitations of this code. Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the *Florida Building Code, Residential.*

2308.1.1 Portions exceeding limitations of conventional construction. When portions of a building of otherwise conventional construction exceed the limits of Section 2308.2, these portions and the supporting load path shall be designed in accordance with accepted engineering practice and the provisions of this code. For the purposes of this section, the term "portions" shall mean parts of buildings containing volume and area such as a room or a series of rooms.

2308.2 Limitations. Buildings are permitted to be constructed in accordance with the provisions of conventional light-frame construction, subject to the following limitations, and to further limitations of Sections 2308.11 and 2308.12.

TABLE 2306.4.1
ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE[a] FOR WIND LOADING[b, h, i, j, l]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING					PANELS APPLIED OVER 1/2" OR 5/8" GYPSUM SHEATHING				
			NAIL (common or galvanized box) or staple size[k]	Fastener spacing at panel edges (inches)				NAIL (common or galvanized box) or staple size[k]	Fastener spacing at panel edges (inches)			
				6	4	3	2[e]		6	4	3	2[e]
Structural I Sheathing	5/16	1 1/4	6d (2 × 0.113" common, 2" × 0.099" galvanized box)	200	300	390	510	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	200	300	390	510
		1	1 1/2 16 Gage	165	245	325	415	2 16 Gage	125	185	245	315
	3/8	1 3/8	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	230[d]	360[d]	460[d]	610[d]	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	280	430	550[f]	730
		1	1 1/2 16 Gage	155	235	315	400	2 16 Gage	155	235	310	400
	7/16	1 3/8	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	255[d]	395[d]	505[d]	670[d]	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	280	430	550[f]	730
		1	1 1/2 16 Gage	170	260	345	440	2 16 Gage	155	235	310	400
	15/32	1 3/8	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	280	430	550	730	10d (3" × 0.148" common, 3" × 0.1218" galvanized box)	280	430	550[f]	730
		1	1 1/2 16 Gage	185	280	375	475	2 16 Gage	155	235	300	400
		1 1/2	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	340	510	665[f]	870	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	—	—	—	—
Sheathing, plywood siding[g] except Group 5 Species	5/16 or 1/4[c]	1 1/4	6d (2" × 0.113" common, 2" × 0.099" galvanized box)	180	270	350	450	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	180	270	350	450
		1	1 1/2 16 Gage	145	220	295	375	2 16 Gage	110	165	220	285
	3/8	1 1/4	6d (2" × 0.113" common, 2" × 0.099" galvanized box)	200	300	390	510	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	200	300	390	510
		1 3/8	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	220[d]	320[d]	410[d]	530[d]	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	260	380	490[f]	640
		1	1 1/2 16 Gage	140	210	280	360	2 16 Gage	140	210	280	360
	7/16	1 3/8	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	240[d]	350[d]	450[d]	585[d]	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	260	380	490[f]	640
		1	1 1/2 16 Gage	155	230	310	395	2 16 Gage	140	210	280	360
	15/32	1 3/8	8d (2 1/2" × 0.131" common, 2 1/2" × 0.113" galvanized box)	260	380	490	640	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	260	380	490[f]	640
		1 1/2	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	310	460	600[f]	770	—	—	—	—	—
		1	1 1/2 16 Gage	170	255	335	430	2 16 Gage	140	210	280	360
	19/32	1 1/2	10d (3" × 0.148" common, 3" × 0.128" galvanized box)	340	510	665[f]	870	—	—	—	—	—
		1	1 3/4 16 Gage	185	280	375	475	—	—	—	—	—
			Nail Size (galvanized casing)					Nail Size (galvanized casing)				
	5/16[c]	1 1/4	6d (2" × 0.099")	140	210	275	360	8d (2 1/2" × 0.113")	140	210	275	360
	3/8	1 3/8	8d (2 1/2" × 0.113")	160	240	310	410	10d (3" × 0.128")	160	240	310[f]	410

(continued)

Notes to Table 2306.4.1

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of other species: (1) Find specific gravity for species of lumber in AF&PA NDS. (2) For staples find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species. (3) For nails find shear value from table above for nail size for actual grade and multiply value by the following adjustment factor: Specific Gravity Adjustment Factor = [1-(0.5 - SG)], where SG = Specific Gravity of the framing lumber. This adjustment factor shall not be greater than 1.

b. Panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space fasteners maximum 6 inches on center along intermediate framing members for $^{3}/_{8}$-inch and $^{7}/_{16}$-inch panels installed on studs spaced 24 inches on center. For other conditions and panel thickness, space fasteners maximum 12 inches on center on intermediate supports.

c. $^{3}/_{8}$-inch panel thickness or siding with a span rating of 16 inches on center is the minimum recommended where applied direct to framing as exterior siding.

d. Allowable shear values are permitted to be increased to values shown for $^{15}/_{32}$-inch sheathing with same nailing provided (a) studs are spaced a maximum of 16 inches on center, or (b) panels are applied with long dimension across studs.

e. Framing at adjoining panel edges shall be 3 inches nominal or wider, and nails shall be staggered where nails are spaced 2 inches on center.

f. Framing at adjoining panel edges shall be 3 inches nominal or wider, and nails shall be staggered where both of the following conditions are met: (1) 10d (3" × 0.148") nails having penetration into framing of more than 1 $^{1}/_{2}$ inches and (2) nails are spaced 3 inches on center.

g. Values apply to all-veneer plywood. Thickness at point of fastening on panel edges governs shear values.

h. Where panels applied on both faces of a wall and nail spacing is less than 6 inches o.c. on either side, panel joints shall be offset to fall on different framing members, or framing shall be 3-inch nominal or thicker at adjoining panel edges and nails on each side shall be staggered.

i. Reserved.

j. Galvanized nails shall be hot dipped or tumbled.

k. Staples shall have a minimum crown width of $^{7}/_{16}$ inch and shall be installed with their crowns parallel to the long dimension of the framing members.

l. For shear loads of normal or permanent load duration as defined by the AF&PA NDS, the values in the table above shall be multiplied by 0.63 or 0.56, respectively.

TABLE 2306.4.3
ALLOWABLE SHEAR FOR PARTICLEBOARD SHEAR WALL SHEATHING[b]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NAIL PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING				
			Nail size (common or galvanized box)	Allowable shear (pounds per foot) nail spacing at panel edges (inches)[a]			
				6	4	3	2
M-S "Exterior Glue" and M-2 "Exterior Glue"	$^{3}/_{8}$	1 $^{1}/_{2}$	6d	120	180	230	300
	$^{3}/_{8}$	1 $^{1}/_{2}$	8d	130	190	240	315
	$^{1}/_{2}$			140	210	270	350
	$^{1}/_{2}$	1 $^{5}/_{8}$	10d	185	275	360	460
	$^{5}/_{8}$			200	305	395	520

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. Values are not permitted in Seismic Design Category D, E or F.

b. Galvanized nails shall be hot-dipped or tumbled.

TABLE 2306.4.4
ALLOWABLE SHEAR VALUES (plf) FOR WIND LOADING ON SHEAR WALLS OF FIBERBOARD SHEATHING BOARD CONSTRUCTION FOR TYPE V CONSTRUCTION ONLY[a,b,c,d,e,f,g,h]

THICKNESS AND GRADE	FASTENER SIZE	SHEAR VALUE (pounds per linear foot) 3-INCH NAIL SPACING AROUND PERIMETER AND 6-INCH AT INTERMEDIATE POINTS
$^{1}/_{2}$" Structural	No. 11 gage galvanized roofing nail 1 $^{1}/_{2}$" long, $^{7}/_{16}$" head	125[g]
$^{25}/_{32}$" Structural	No. 11 gage galvanized roofing nail 1 $^{3}/_{4}$" long, $^{7}/_{16}$" head	175[g]

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. Fiberboard sheathing diaphragms shall not be used to brace concrete or masonry walls.

b. Panel edges shall be backed with 2 inch or wider framing of Douglas fir-larch or Southern pine.

c. Fiberboard sheathing on one side only.

d. Fiberboard panels are installed with their long dimension parallel or perpendicular to studs.

e. Fasteners shall be spaced 6 inches on center along intermediate framing members.

f. For framing of other species: (1) Find specific gravity for species of lumber in AF&PA NDS and (2) Multiply the shear value from the above table by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.

g. The same values can be applied when staples are used as described in Table 2304.9.1.

h. Reserved.

TABLE 2306.4.5
ALLOWABLE SHEAR FOR WIND FORCES FOR SHEAR WALLS OF LATH AND PLASTER OR GYPSUM BOARD WOOD FRAMED WALL ASSEMBLIES

TYPE OF MATERIAL	THICKNESS OF MATERIAL	WALL CONSTRUCTION	FASTENER SPACING[b] MAXIMUM (inches)	SHEAR VALUE[a,e] (plf)	MINIMUM FASTENER SIZE[c,d,j,k]
1. Expanded metal or woven wire lath and portland cement plaster	7/8"	Unblocked	6	180	No. 11 gage 1 1/2" long, 7/16" head 16 Ga. Galv. Staple, 7/8" legs
2. Gypsum lath, plain or perforated	3/8" lath and 1/2" plaster	Unblocked	5	100	No. 13 gage, 1 1/8" long, 9/64" head, plasterboard nail 16 Ga. Galv. Staple, 1 1/8" long 0.120" Nail, min. 3/8" head, 1 1/4" long
3. Gypsum sheathing	1/2" × 2' × 8'	Unblocked	4	75	No. 11 gage, 1 3/4" long, 7/16" head, diamond-point, galvanized
	1/2" × 4'	Blocked[f] Unblocked	4 7	175 100	16 Ga. Galv. Staple, 1 3/4" long
	5/8" × 4'	Blocked	4" edge/ 7" field	200	6d galvanized 0.120" Nail, min. 3/8" head, 1 3/4" long
4. Gypsum board, gypsum veneer base or water-resistant gypsum backing board	1/2"	Unblocked[f]	7	75	5d cooler (1 5/8" x .086") or wallboard 0.120" nail, min. 3/8 " head, 1 1/2 " long 16 Gage Staple, 1 1/2" long
		Unblocked[f]	4	110	
		Unblocked	7	100	
		Unblocked	4	125	
		Blocked[g]	7	125	
		Blocked[g]	4	150	
		Unblocked	8/12[h]	60	No. 6 1 1/4" screws[i]
		Blocked[g]	4/16[h]	160	
		Blocked[g]	4/12[h]	155	
		Blocked[f, g]	8/12[h]	70	
		Blocked[g]	6/12[h]	90	
	5/8"	Unblocked[f]	7	115	6d cooler (1 7/8" x 0.092") or wallboard 0.120" Nail, min. 3/8" head, 1 3/4" long 16 Gage Staple, 1 1/2" legs, 1 5/8" long
			4	145	
		Blocked[g]	7	145	
			4	175	
		Blocked[g] Two-ply	Base ply: 9 Face ply: 7	250	Base ply-6d cooler (1 7/8" × 0.092") or wallboard 1 3/4" x 0.120" Nail, min. 3/8" head 1 5/8" 16 Ga. Galv. Staple 1 5/8" 16 Gage Galv. Staple Face ply-8d cooler (2 3/8" × 0.113") or wallboard 0.120" Nail, min. 3/8" head, 2 3/8" long 15 Ga. Galv. Staple, 2 1/4" long
		Unblocked	8/12[h]	70	No. 6-1 1/4" screws[i]
		Blocked[g]	8/12[h]	90	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per foot = 14.5939 N/m.

a. These shear walls shall not be used to resist loads imposed by masonry or concrete construction (see Section 2305.1.5). Values shown are for short-term loading due to wind loading. Values shown shall be reduced 25 percent for normal loading.

b. Applies to fastening at studs, top and bottom plates and blocking.

c. Alternate fasteners are permitted to be used if their dimensions are not less than the specified dimensions. Drywall screws are permitted to substitute for the 5d (1 5/8" × 0.086"), and 6d (1 7/8" × 0.092")(cooler) nails listed above, and No. 6 1 1/4 inch Type S or W screws for 6d (1 7/8" × 0.092) (cooler) nails.

d. For properties of cooler nails, see ASTM C 514.

e. Except as noted, shear values are based on a maximum framing spacing of 16 inches on center.

f. Maximum framing spacing of 24 inches on center.

g. All edges are blocked, and edge fastening is provided at all supports and all panel edges.

h. First number denotes fastener spacing at the edges; second number denotes fastener spacing at intermediate framing members.

i. Screws are Type W or S.

j. Staples shall have a minimum crown width of 7/16 inch, measured outside the legs, and shall be installed with their crowns parallel to the long dimension of the framing members.

k. Staples for the attachment of gypsum lath and woven-wire lath shall have a minimum crown width of 3/4 inch, measured outside the legs.

1. Buildings shall be limited to a maximum of three stories above grade.
2. Maximum floor-to-floor height shall not exceed 11 feet 7 inches (3529 mm). Bearing wall height shall not exceed a stud height of 10 feet (3048 mm).
3. Loads as determined in Chapter 16 shall not exceed the following:
   3.1. Average dead loads shall not exceed 15 psf (718 N/m^2) for combined roof and ceiling, exterior walls, floors and partitions.

   Exceptions:

   1. Subject to the limitations of Sections 2308.11.2 and 2308.12.2, stone or masonry veneer up to the lesser of 5 inches (127 mm) thick or 50 psf (2395 N/m^2) and installed in accordance with Chapter 14 is permitted to a height of 30 feet (9144 mm) above a noncombustible foundation, with an additional 8 feet (2438 mm) permitted for gable ends.
   2. Concrete or masonry fireplaces, heaters and chimneys shall be permitted in accordance with the provisions of this code.

   3.2. Live loads shall not exceed 40 psf (1916 N/m^2) for floors.
4. Wind speeds shall not exceed 100 miles per hour (mph) (44 m/s) (3-second gust).
5. Roof trusses and rafters shall not span more than 40 feet (12 192 mm) between points of vertical support.
6. Reserved.
7. Reserved.

2308.2.1 Basic wind speed greater than 100 mph (3-second gust). Where the basic wind speed exceeds 100 mph (3-second gust), the provisions of either the AF&PA *Wood Frame Construction Manual for One- and Two-Family Dwellings* (WFCM) or the IBHS *Guideline for Hurricane Resistant Residential Construction*, are permitted to be used.

2308.2.2 Buildings in Seismic Design Category B, C, D or E. Reserved.

2308.3 Braced wall lines. Buildings shall be provided with exterior and interior braced wall lines as described in Section 2308.9.3 and installed in accordance with Sections 2308.3.1 through 2308.3.4.

2308.3.1 Spacing. Spacing of braced wall lines shall not exceed 35 feet (10 668 mm) o.c. in both the longitudinal and transverse directions in each story.

2308.3.2 Braced wall panel connections. Forces shall be transferred from the roofs and floors to braced wall panels and from the braced wall panels in upper stories to the braced wall panels in the story below by the following:

1. Braced wall panel top and bottom plates shall be fastened to joists, rafters or full-depth blocking. Braced wall panels shall be extended and fastened to roof framing at intervals not to exceed 50 feet (15 240 mm) between parallel braced wall lines.

   Exception: Where roof trusses are used, lateral forces shall be transferred from the roof diaphragm to the braced wall by blocking of the ends of the trusses or by other approved methods.
2. Bottom plate fastening to joist or blocking below shall be with not less than 3-16d nails at 16 inches (406 mm) o.c.
3. Blocking shall be nailed to the top plate below with not less than 3-8d toenails per block.
4. Joists parallel to the top plates shall be nailed to the top plate with not less than 8d toenails at 6 inches (152 mm) o.c.

In addition, top plate laps shall be nailed with not less than 8-16d face nails on each side of each break in the top plate.

2308.3.3 Sill anchorage. Where foundations are required by Section 2308.3.4, braced wall line sills shall be anchored to concrete or masonry foundations. Such anchorage shall conform to the requirements of Section 2308.6 except that such anchors shall be spaced at not more than 4 feet (1219 mm) o.c. for structures over two stories in height. The anchors shall be distributed along the length of the braced wall line. Other anchorage devices having equivalent capacity are permitted.

2308.3.3.1 Anchorage to all-wood foundations. Where all-wood foundations are used, the force transfer from the braced wall lines shall be determined based on calculation and shall have a capacity greater than or equal to the connections required by Section 2308.3.3.

2308.3.4 Braced wall line support. Braced wall lines shall be supported by continuous foundations.

Exception: For structures with a maximum plan dimension not over 50 feet (15 240 mm), continuous foundations are required at exterior walls only.

2308.4 Design of elements. Combining of engineered elements or systems and conventionally specified elements or systems is permitted subject to the following limits:

2308.4.1 Elements exceeding limitations of conventional construction. When a building of otherwise conventional construction contains structural elements exceeding the limits of Section 2308.2, these elements and the supporting load path shall be designed in accordance with accepted engineering practice and the provisions of this code.

2308.4.2 Structural elements or systems not described herein. When a building of otherwise conventional construction contains structural elements or systems not described in Section 2308, these elements or systems shall be designed in accordance with accepted engineering practice and the provisions of this code. The extent of such design need only demonstrate compliance of the nonconventional elements with other applicable provisions of this code and shall be compatible with the performance of the conventionally framed system.

2308.5 Connections and fasteners. Connections and fasteners used in conventional construction shall comply with the requirements of Section 2304.9.

2308.6 Foundation plates or sills. Foundations and footings shall be as specified in Chapter 18. Foundation plates or sills resting on concrete or masonry foundations shall comply with Section 2304.3.1. Foundation plates or sills shall be bolted or anchored to the foundation with not less than $^1/_2$-inch-diameter (12.7 mm) steel bolts or approved anchors spaced to provide equivalent anchorage as the steel bolts. Bolts shall be embedded at least 7 inches (178 mm) into concrete or masonry, and spaced not more than 6 feet (1829 mm) apart. There shall be a minimum of two bolts or anchor straps per piece with one bolt or anchor strap located not more than 12 inches (305 mm) or less than 4 inches (102 mm) from each end of each piece. A properly sized nut and washer shall be tightened on each bolt to the plate.

2308.7 Girders. Girders for single-story construction or girders supporting loads from a single floor shall not be less than 4 inches by 6 inches (102 mm by 152 mm) for spans 6 feet (1829 mm) or less, provided that girders are spaced not more than 8 feet (2438 mm) o.c. Spans for built-up 2-inch (51 mm) girders shall be in accordance with Table 2308.9.5 or 2308.9.6. Other girders shall be designed to support the loads specified in this code. Girder end joints shall occur over supports.

Where a girder is spliced over a support, an adequate tie shall be provided. The ends of beams or girders supported on masonry or concrete shall not have less than 3 inches (76 mm) of bearing.

2308.8 Floor joists. Spans for floor joists shall be in accordance with Table 2308.8(1) or 2308.8(2). For other grades and or species, refer to the *AF&PA Span Tables for Joists and Rafters*.

2308.8.1 Bearing. Except where supported on a 1-inch by 4-inch (25.4 mm by 102 mm) ribbon strip and nailed to the adjoining stud, the ends of each joist shall not have less than $1^1/_2$ inches (38 mm) of bearing on wood or metal, or less than 3 inches (76 mm) on masonry.

2308.8.2 Framing details. Joists shall be supported laterally at the ends and at each support by solid blocking except where the ends of the joists are nailed to a header, band or rim joist or to an adjoining stud or by other means. Solid blocking shall not be less than 2 inches (51mm) in thickness and the full depth of the joist. Notches on the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

Joist framing from opposite sides of a beam, girder or partition shall be lapped at least 3 inches (76 mm) or the opposing joists shall be tied together in an approved manner.

Joists framing into the side of a wood girder shall be supported by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

2308.8.2.1 Engineered wood products. Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members or I-joists are not permitted except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

2308.8.3 Framing around openings. Trimmer and header joists shall be doubled, or of lumber of equivalent cross section, where the span of the header exceeds 4 feet (1219 mm). The ends of header joists more than 6 feet (1829 mm) long shall be supported by framing anchors or joist hangers unless bearing on a beam, partition or wall. Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

2308.8.4 Supporting bearing partitions. Bearing partitions parallel to joists shall be supported on beams, girders, doubled joists, walls or other bearing partitions. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth unless such joists are of sufficient size to carry the additional load.

2308.8.5 Lateral support. Floor, attic and roof framing with a nominal depth-to-thickness ratio greater than or equal to 5:1 shall have one edge held in line for the entire span. Where the nominal depth-to-thickness ratio of the framing member exceeds 6:1, there shall be one line of bridging for each 8 feet (2438 mm) of span, unless both edges of the member are held in line. The bridging shall consist of not less than 1-inch by 3-inch (25 mm by 76 mm) lumber, double nailed at each end, of equivalent metal bracing of equal rigidity, full-depth solid blocking or other approved means. A line of bridging shall also be required at supports where equivalent lateral support is not otherwise provided.

2308.8.6 Structural floor sheathing. Structural floor sheathing shall comply with the provisions of Section 2304.7.1.

2308.8.7 Under-floor ventilation. For under-floor ventilation, see Section 1203.3.

2308.9 Wall framing.

2308.9.1 Size, height and spacing. The size, height and spacing of studs shall be in accordance with Table 2308.9.1 except that utility-grade studs shall not be spaced more than 16 inches (406 mm) o.c., or support more than a roof and ceiling, or exceed 8 feet (2438 mm) in height for exterior walls and load-bearing walls or 10 feet (3048 mm) for interior nonload-bearing walls.

TABLE 2308.8(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential Sleeping Areas, Live Load = 30 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	12-6	16-6	21-0	25-7	12-6	16-6	21-0	25-7
	Douglas Fir-Larch	#1	12-0	15-10	20-3	24-8	12-0	15-7	19-0	22-0
	Douglas Fir-Larch	#2	11-10	15-7	19-10	23-0	11-6	14-7	17-9	20-7
	Douglas Fir-Larch	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Hem-Fir	SS	11-10	15-7	19-10	24-2	11-10	15-7	19-10	24-2
	Hem-Fir	#1	11-7	15-3	19-5	23-7	11-7	15-2	18-6	21-6
	Hem-Fir	#2	11-0	14-6	18-6	22-6	11-0	14-4	17-6	20-4
	Hem-Fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Southern Pine	SS	12-3	16-2	20-8	25-1	12-3	16-2	20-8	25-1
	Southern Pine	#1	12-0	15-10	20-3	24-8	12-0	15-10	20-3	24-8
	Southern Pine	#2	11-10	15-7	19-10	24-2	11-10	15-7	18-7	21-9
	Southern Pine	#3	10-5	13-3	15-8	18-8	9-4	11-11	14-0	16-8
	Spruce-Pine-Fir	SS	11-7	15-3	19-5	23-7	11-7	15-3	19-5	23-7
	Spruce-Pine-Fir	#1	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-Pine-Fir	#2	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-Pine-Fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
16	Douglas Fir-Larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-0
	Douglas Fir-Larch	#1	10-11	14-5	18-5	21-4	10-8	13-6	16-5	19-1
	Douglas Fir-Larch	#2	10-9	14-1	17-2	19-11	9-11	12-7	15-5	17-10
	Douglas Fir-Larch	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Hem-Fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-Fir	#1	10-6	13-10	17-8	20-9	10-4	13-1	16-0	18-7
	Hem-Fir	#2	10-0	13-2	16-10	19-8	9-10	12-5	15-2	17-7
	Hem-Fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Southern Pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern Pine	#1	10-11	14-5	18-5	22-5	10-11	14-5	17-11	21-4
	Southern Pine	#2	10-9	14-2	18-0	21-1	10-5	13-6	16-1	18-10
	Southern Pine	#3	9-0	11-6	13-7	16-2	8-1	10-3	12-2	14-6
	Spruce-Pine-Fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-4
	Spruce-Pine-Fir	#1	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-Pine-Fir	#2	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-Pine-Fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6

(continued)

TABLE 2308.8(1)—continued
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential Sleeping Areas, Live Load = 30 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	10-8	14-1	18-0	21-10	10-8	14-1	18-0	21-0
	Douglas Fir-Larch	#1	10-4	13-7	16-9	19-6	9-8	12-4	15-0	17-5
	Douglas Fir-Larch	#2	10-1	12-10	15-8	18-3	9-1	11-6	14-1	16-3
	Douglas Fir-Larch	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
	Hem-Fir	SS	10-1	13-4	17-0	20-8	10-1	13-4	17-0	20-7
	Hem-Fir	#1	9-10	13-0	16-4	19-0	9-6	12-0	14-8	17-0
	Hem-Fir	#2	9-5	12-5	15-6	17-1	8-11	11-4	13-10	16-1
	Hem-Fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
	Southern Pine	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Southern Pine	#1	10-4	13-7	17-4	21-1	10-4	13-7	16-4	19-6
	Southern Pine	#2	10-1	13-4	16-5	19-3	9-6	12-4	14-8	17-2
	Southern Pine	#3	8-3	10-6	12-5	14-9	7-4	9-5	11-1	13-2
	Spruce-Pine-Fir	SS	9-10	13-0	16-7	20-2	9-10	13-0	16-7	19-6
	Spruce-Pine-Fir	#1	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#2	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
24	Douglas Fir-Larch	SS	9-11	13-1	16-8	20-3	9-11	13-1	16-2	18-9
	Douglas Fir-Larch	#1	9-7	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Douglas Fir-Larch	#2	9-1	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Douglas Fir-Larch	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Hem-Fir	SS	9-4	12-4	15-9	19-2	9-4	12-4	15-9	18-5
	Hem-Fir	#1	9-2	12-0	14-8	17-0	8-6	10-9	13-1	15-2
	Hem-Fir	#2	8-9	11-4	13-10	16-1	8-0	10-2	12-5	14-4
	Hem-Fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Southern Pine	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Southern Pine	#1	9-7	12-7	16-1	19-6	9-7	12-4	14-7	17-5
	Southern Pine	#2	9-4	12-4	14-8	17-2	8-6	11-0	13-1	15-5
	Southern Pine	#3	7-4	9-5	11-1	13-2	6-7	8-5	9-11	11-10
	Spruce-Pine-Fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-0	17-5
	Spruce-Pine-Fir	#1	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-Pine-Fir	#2	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-Pine-Fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m^2.

TABLE 2308.8(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential Living Areas, Live Load = 40 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas Fir-Larch	#1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas Fir-Larch	#2	10-9	14-2	17-9	20-7	10-6	13-3	16-3	18-10
	Douglas Fir-Larch	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Hem-Fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-Fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	16-11	19-7
	Hem-Fir	#2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-Fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern Pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern Pine	#1	10-11	14-5	18-5	22-5	10-11	14-5	18-5	22-5
	Southern Pine	#2	10-9	14-2	18-0	21-9	10-9	14-2	16-11	19-10
	Southern Pine	#3	9-4	11-11	14-0	16-8	8-6	10-10	12-10	15-3
	Spruce-Pine-Fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-Pine-Fir	#1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-Pine-Fir	#2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-Pine-Fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas Fir-Larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-0
	Douglas Fir-Larch	#1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas Fir-Larch	#2	9-9	12-7	15-5	17-10	9-1	11-6	14-1	16-3
	Douglas Fir-Larch	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Hem-Fir	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-Fir	#1	9-6	12-7	16-0	18-7	9-6	12-0	14-8	17-0
	Hem-Fir	#2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-Fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern Pine	SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern Pine	#1	9-11	13-1	16-9	20-4	9-11	13-1	16-4	19-6
	Southern Pine	#2	9-9	12-10	16-1	18-10	9-6	12-4	14-8	17-2
	Southern Pine	#3	8-1	10-3	12-2	14-6	7-4	9-5	11-1	13-2
	Spruce-Pine-Fir	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-Pine-Fir	#1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#2	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4

(continued)

TABLE 2308.8(2)—continued
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential Living Areas, Live Load = 40 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2x6	2x8	2x10	2x12	2x6	2x8	2x10	2x12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-2
	Douglas Fir-Larch	#1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas Fir-Larch	#2	9-1	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Douglas Fir-Larch	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Hem-Fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-Fir	#1	9-0	11-10	14-8	17-0	8-8	10-11	13-4	15-6
	Hem-Fir	#2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-Fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern Pine	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern Pine	#1	9-4	12-4	15-9	19-2	9-4	12-4	14-11	17-9
	Southern Pine	#2	9-2	12 -1	14-8	17-2	8-8	11-3	13-5	15-8
	Southern Pine	#3	7-4	9-5	11-1	13-2	6-9	8-7	10-1	12-1
	Spruce-Pine-Fir	SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-Pine-Fir	#1	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-Pine-Fir	#2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-Pine-Fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
24	Douglas Fir-Larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	14-9	17-1
	Douglas Fir-Larch	#1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas Fir-Larch	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Douglas Fir-Larch	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Hem-Fir	SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10[a]
	Hem-Fir	#1	8-4	10-9	13-1	15-2	7-9	9-9	11-11	13-10
	Hem-Fir	#2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-Fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern Pine	SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-1
	Southern Pine	#1	8-8	11-5	14-7	17-5	8-8	11-3	13-4	15-11
	Southern Pine	#2	8-6	11-0	13-1	15-5	7-9	10-0	12-0	14-0
	Southern Pine	#3	6-7	8-5	9-11	11-10	6-0	7-8	9-1	10-9
	Spruce-Pine-Fir	SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-Pine-Fir	#1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-Pine-Fir	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-Pine-Fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

Check sources for availability of lumber in lengths greater than 20 feet.
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m^2.
a. End bearing length shall be increased to 2 inches.

TABLE 2308.9.1
SIZE, HEIGHT AND SPACING OF WOOD STUDS

STUD SIZE (inches)	BEARING WALLS				NONBEARING WALLS	
	Laterally unsupported stud height[a] (feet)	Supporting roof and ceiling only	Supporting one floor, roof and ceiling	Supporting two floors, roof and ceiling	Laterally unsupported stud height[a] (feet)	Spacing (inches)
	Spacing (inches)					
2 × 3[b]	—	—	—	—	10	16
2 × 4	10	24	16	—	14	24
3 × 4	10	24	24	16	14	24
2 × 5	10	24	24	—	16	24
2 × 6	10	24	24	16	20	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by an analysis.

b. Shall not be used in exterior walls.

2308.9.2 Framing details. Studs shall be placed with their wide dimension perpendicular to the wall. Not less than three studs shall be installed at each corner of an exterior wall.

Exception: At corners, two studs are permitted, provided wood spacers or backup cleats of $^3/_8$-inch-thick (9.5 mm) wood structural panel, $^3/_8$-inch (9.5 mm) Type M "Exterior Glue" particleboard, 1-inch-thick (25 mm) lumber or other approved devices that will serve as an adequate backing for the attachment of facing materials are used. Where fire-resistance ratings or shear values are involved, wood spacers, backup cleats or other devices shall not be used unless specifically approved for such use.

2308.9.2.1 Top plates. Bearing and exterior wall studs shall be capped with double top plates installed to provide overlapping at corners and at intersections with other partitions. End joints in double top plates shall be offset at least 48 inches (1219 mm), and shall be nailed with not less than eight 16d face nails on each side of the joint. Plates shall be a nominal 2 inches (51 mm) in depth and have a width at least equal to the width of the studs.

Exception: A single top plate is permitted, provided the plate is adequately tied at joints, corners and intersecting walls by at least the equivalent of 3-inch by 6-inch (76 mm by 152 mm) by 0.036-inch-thick (0.914 mm) galvanized steel that is nailed to each wall or segment of wall by six 8d nails or equivalent, provided the rafters, joists or trusses are centered over the studs with a tolerance of no more than 1 inch (25 mm).

2308.9.2.2 Top plates for studs spaced at 24 inches (610 mm). Where bearing studs are spaced at 24-inch (610 mm) intervals and top plates are less than two 2-inch by 6-inch (51 mm by 152 mm) or two 3-inch by 4-inch (76 mm by 102 mm) members and where the floor joists, floor trusses or roof trusses that they support are spaced at more than 16-inch (406 mm) intervals, such joists or trusses shall bear within 5 inches (127 mm) of the studs beneath or a third plate shall be installed.

2308.9.2.3 Nonbearing walls and partitions. In nonbearing walls and partitions, studs shall be spaced not more than 28 inches (711 mm) o.c. and are permitted to be set with the long dimension parallel to the wall. Interior nonbearing partitions shall be capped with no less than a single top plate installed to provide overlapping at corners and at intersections with other walls and partitions. The plate shall be continuously tied at joints by solid blocking at least 16 inches (406 mm) in length and equal in size to the plate or by $^1/_2$-inch by $1^1/_2$-inch (12.7 mm by 38 mm) metal ties with spliced sections fastened with two 16d nails on each side of the joint.

2308.9.2.4 Plates or sills. Studs shall have full bearing on a plate or sill not less than 2 inches (51 mm) in thickness having a width not less than that of the wall studs.

2308.9.3 Bracing. Braced wall lines shall consist of braced wall panels that meet the requirements for location, type and amount of bracing as shown in Figure 2308.9.3, specified in Table 2308.9.3(1) and are in line or offset from each other by not more than 4 feet (1219 mm). Braced wall panels shall start not more than $12^1/_2$-feet (3810 mm) from each end of a braced wall line. Braced wall panels shall be clearly indicated on the plans. Construction of braced wall panels shall be by one of the following methods:

1. Nominal 1-inch by 4-inch (25 mm by 102 mm) continuous diagonal braces let into top and bottom plates and intervening studs, placed at an angle not more than 60 degrees (1.0 rad) or less than 45 degrees (0.79 rad) from the horizontal and attached to the framing in conformance with Table 2304.9.1.
2. Wood boards of $^5/_8$ inch (15.9 mm) net minimum thickness applied diagonally on studs spaced not over 24 inches (610 mm) o.c.
3. Wood structural panel sheathing with a thickness not less than $^5/_{16}$ inch (7.9 mm) for a 16-inch (406 mm) stud spacing and not less than $^3/_8$ inch (9.5 mm) for a 24-inch (610 mm) stud spacing in accordance with Tables 2308.9.3(2) and 2308.9.3(3).
4. Fiberboard sheathing panels not less than $^1/_2$ inch (12.7 mm) thick applied vertically or horizontally on studs spaced not over 16 inches (406 mm) o.c. where

installed with fasteners in accordance with Section 2306.4.4 and Table 2306.4.4.

5. Gypsum board [sheathing $^1/_2$-inch-thick (12.7 mm) by 4-feet-wide (1219 mm) wallboard or veneer base] on studs spaced not over 24 inches (610 mm) o.c. and nailed at 7 inches (178 mm) o.c. with nails as required by Table 2306.4.5.
6. Particleboard wall sheathing panels where installed in accordance with Table 2308.9.3(4).
7. Portland cement plaster on studs spaced 16 inches (406 mm) o.c. installed in accordance with Section 2510.
8. Hardboard panel siding where installed in accordance with Section 2303.1.6 and Table 2308.9.3(5).

For cripple wall bracing, see Section 2308.9.4.1. For Methods 2, 3, 4, 6, 7 and 8, each panel must be at least 48 inches (1219 mm) in length, covering three stud spaces where studs are spaced 16 inches (406 mm) apart and covering two stud spaces where studs are spaced 24 inches (610 mm) apart.

For Method 5, each panel must be at least 96 inches (2438 mm) in length where applied to one face of a panel and 48 inches (1219 mm) where applied to both faces.

All vertical joints of panel sheathing shall occur over studs and adjacent panel joints shall be nailed to common framing members. Horizontal joints shall occur over blocking or other framing equal in size to the studding except where waived by the installation requirements for the specific sheathing materials.

Sole plates shall be nailed to the floor framing and top plates shall be connected to the framing above in accordance with Section 2308.3.2. Where joists are perpendicular to braced wall lines above, blocking shall be provided under and in line with the braced wall panels.

2308.9.3.1 Alternative bracing. Any bracing required by Section 2308.9.3 is permitted to be replaced by the following:

1. In one-story buildings, each panel shall have a length of not less than 2 feet 8 inches (813 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with $^3/_8$-inch-minimum-thickness (9.5 mm) wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Table 2304.9.1 and blocked at wood structural panel edges. Two anchor bolts installed in accordance with Section 2308.6 shall be provided in each panel. Anchor bolts shall be placed at each panel outside quarter points. Each panel end stud shall have a tie-down device fastened to the foundation, capable of providing an approved uplift capacity of not less than 1,800 pounds (8006 N). The tie-down device shall be installed in accordance with the manufacturer's recommendations. The panels shall be supported directly on a foundation or on floor framing supported directly on a foundation that is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom.

   Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch by 12-inch (305 mm by 305 mm) continuous footing or turned down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.
2. In the first story of two-story buildings, each wall panel shall be braced in accordance with Section 2308.9.3.1, Item 1, except that the wood structural panel sheathing shall be provided on both faces, three anchor bolts shall be placed at one-quarter points, and tie-down device uplift capacity shall not be less than 3,000 pounds (13 344 N).

2308.9.3.2 Alternate bracing wall panel adjacent to a door or window opening. Any bracing required by Section 2308.9.3 is permitted to be replaced by the following when used adjacent to a door or window opening with a full-length header:

1. In one-story buildings, each panel shall have a length of not less than 16 inches (406 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with a single layer of $^3/_8$ inch (9.5 mm) minimum thickness wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Figure 2308.9.3.2. The wood structural panel sheathing shall extend up over the solid sawn or glued-laminated header and shall be nailed in accordance with Figure 2308.9.3.2. A built-up header consisting of at least two 2 x 12s and fastened in accordance with Item 24 of Table 2304.9.1 shall be permitted to be used. A spacer, if used, shall be placed on the side of the built-up beam opposite the wood structural panel sheathing. The header shall extend between the inside faces of the first full-length outer studs of each panel. The clear span of the header between the inner studs of each panel shall be not less than 6 feet (1829 mm) and not more than 18 feet (5486 mm) in length. A strap with an uplift capacity of not less than 1,000 pounds (4,400 N) shall fasten the header to the inner studs opposite the sheathing. One anchor bolt not less than $^5/_8$ inch (15.9 mm) diameter and installed in accordance with Section 2308.6 shall be provided in the center of each sill plate. The studs at each end of the panel shall have a tie-down device fastened to the foundation with an uplift capacity of not less than 4,200 pounds (18 480 N).

   Where a panel is located on one side of the opening, the header shall extend between the inside

face of the first full-length stud of the panel and the bearing studs at the other end of the opening. A strap with an uplift capacity of not less than 1,000 pounds (4400 N) shall fasten the header to the bearing studs. The bearing studs shall also have a tie-down device fastened to the foundation with an uplift capacity of not less than 1,000 pounds (4400 N).

The tie-down devices shall be an embedded strap type, installed in accordance with the manufacturer's recommendations. The panels shall be supported directly on a foundation that is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom.

Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch by 12-inch (305 mm by 305 mm) continuous footing or turned down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped not less than 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.

2. In the first story of two-story buildings, each wall panel shall be braced in accordance with Item 1 above, except that each panel shall have a length of not less than 24 inches (610 mm).

2308.9.4 Cripple walls. Foundation cripple walls shall be framed of studs not less in size than the studding above with a minimum length of 14 inches (356 mm), or shall be framed of solid blocking. Where exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story.

2308.9.4.1 Bracing. For the purposes of this section, cripple walls having a stud height exceeding 14 inches (356 mm) shall be considered a story and shall be braced in accordance with Table 2308.9.3(1).

2308.9.4.2 Nailing of bracing. Spacing of edge nailing for required wall bracing shall not exceed 6 inches (152 mm) o.c. along the foundation plate and the top plate of the cripple wall. Nail size, nail spacing for field nailing and more restrictive boundary nailing requirements shall be as required elsewhere in the code for the specific bracing material used.

2308.9.5 Openings in exterior walls.

2308.9.5.1 Headers. Headers shall be provided over each opening in exterior-bearing walls. The spans in Table 2308.9.5 are permitted to be used for one- and two-family dwellings. Headers for other buildings shall be designed in accordance with Section 2301.2, Item 1 or 2. Headers shall be of two pieces of nominal 2-inch (51 mm) framing lumber set on edge as permitted by Table 2308.9.5 and nailed together in accordance with Table 2304.9.1 or of solid lumber of equivalent size.

2308.9.5.2 Header support. Wall studs shall support the ends of the header in accordance with Table 2308.9.5. Each end of a lintel or header shall have a length of bearing of not less than $1^1/_2$ inches (38 mm) for the full width of the lintel.

2308.9.6 Openings in interior bearing partitions. Headers shall be provided over each opening in interior bearing partitions as required in Section 2308.9.5. The spans in Table 2308.9.6 are permitted to be used. Wall studs shall support the ends of the header in accordance with Table 2308.9.5 or 2308.9.6, as appropriate.

2308.9.7 Openings in interior nonbearing partitions. Openings in nonbearing partitions are permitted to be framed with single studs and headers. Each end of a lintel or header shall have a length of bearing of not less than $1^1/_2$ inches (38 mm) for the full width of the lintel.

2308.9.8 Pipes in walls. Stud partitions containing plumbing, heating or other pipes shall be so framed and the joists underneath so spaced as to give proper clearance for the piping. Where a partition containing such piping runs parallel to the floor joists, the joists underneath such partitions shall be doubled and spaced to permit the passage of such pipes and shall be bridged. Where plumbing, heating or other pipes are placed in or partly in a partition, necessitating the cutting of the soles or plates, a metal tie not less than 0.058 inch (1.47 mm) (16 galvanized gage) and $1^1/_2$ inches (38 mm) wide shall be fastened to each plate across and to each side of the opening with not less than six 16d nails.

2308.9.9 Bridging. Unless covered by interior or exterior wall coverings or sheathing meeting the minimum requirements of this code, stud partitions or walls with studs having a height-to-least-thickness ratio exceeding 50 shall have bridging not less than 2 inches (51 mm) in thickness and of the same width as the studs fitted snugly and nailed thereto to provide adequate lateral support. Bridging shall be placed in every stud cavity and at a frequency such that no stud so braced shall have a height-to-least-thickness ratio exceeding 50 with the height of the stud measured between horizontal framing and bridging or between bridging, whichever is greater.

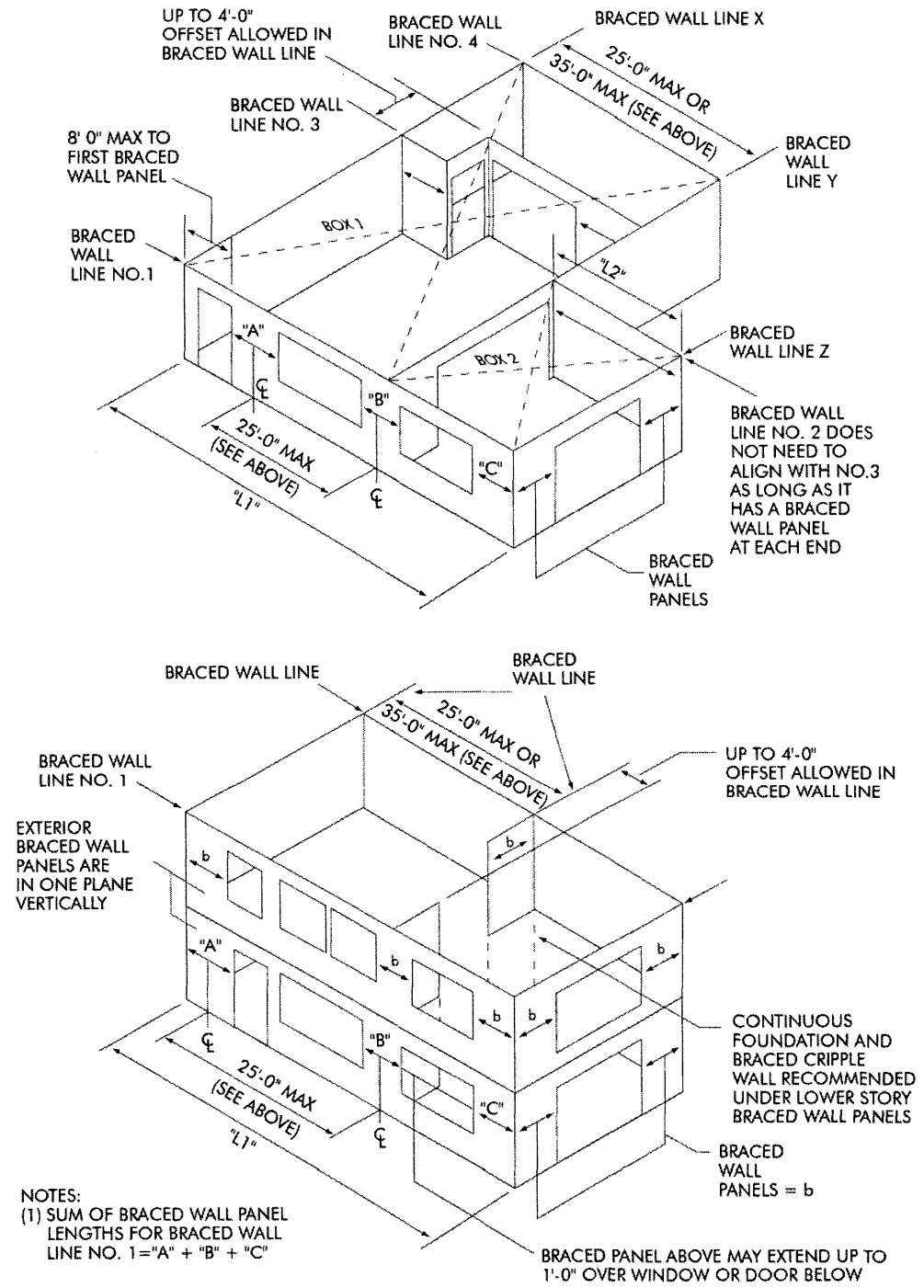
2308.9.10 Cutting and notching. In exterior walls and bearing partitions, any wood stud is permitted to be cut or notched to a depth not exceeding 25 percent of its width. Cutting or notching of studs to a depth not greater than 40 percent of the width of the stud is permitted in nonbearing partitions supporting no loads other than the weight of the partition.

2308.9.11 Bored holes. A hole not greater in diameter than 40 percent of the stud width is permitted to be bored in any wood stud. Bored holes not greater than 60 percent of the width of the stud are permitted in nonbearing partitions or in any wall where each bored stud is doubled, provided not more than two such successive doubled studs are so bored.

In no case shall the edge of the bored hole be nearer than $^5/_8$ inch (15.9 mm) to the edge of the stud.

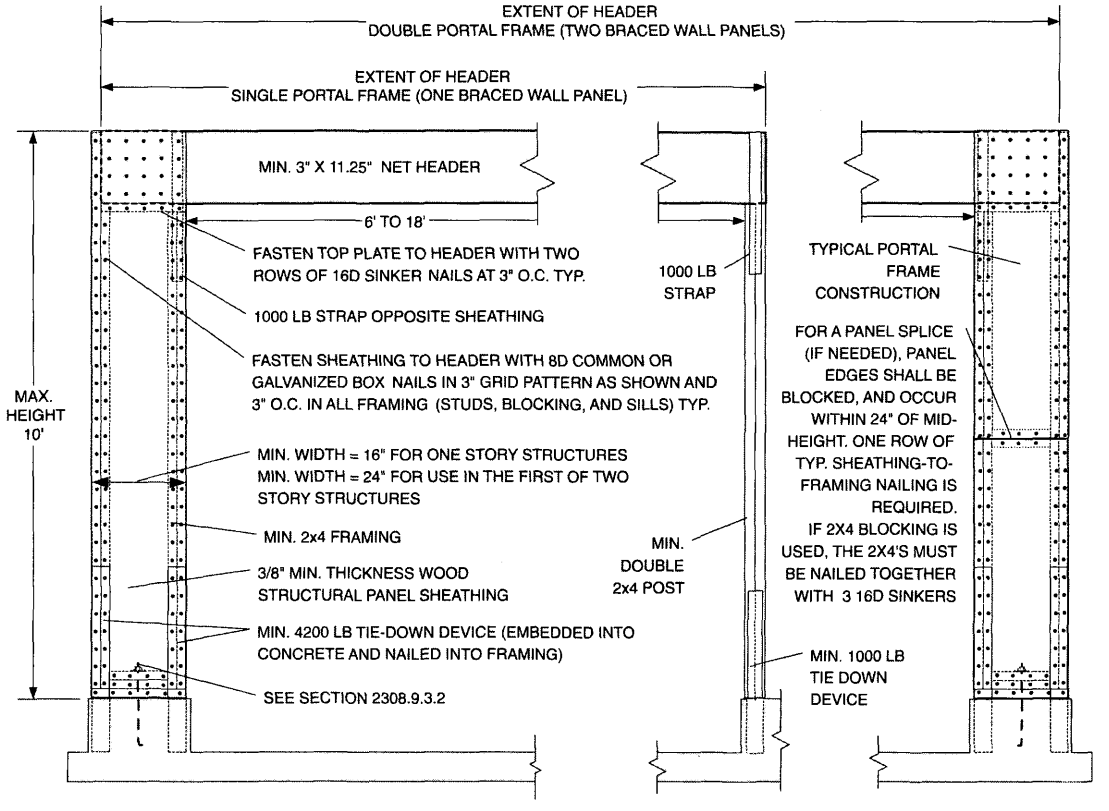
Bored holes shall not be located at the same section of stud as a cut or notch.

MAXIMUM WALL SPACING (feet)	REQUIRED BRACING LENGTH, b
35'-0"	Table 2308.9.3(1) and Section 2308.9.3



For SI: 1 foot = 304.8 mm.

FIGURE 2308.9.3
BASIC COMPONENTS OF THE LATERAL BRACING SYSTEM



For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm; 1 pound = 4.448 N.

FIGURE 2308.9.3.2
ALTERNATE BRACED WALL PANEL ADJACENT TO A DOOR OR WINDOW OPENING

TABLE 2308.9.3(1)
BRACED WALL PANELS[a]

CONDITION	CONSTRUCTION METHODS[b,c]								BRACED PANEL LOCATION AND LENGTH[d]
	1	2	3	4	5	6	7	8	
One story, top of two or three story	X	X	X	X	X	X	X	X	Location in accordance with Section 2308.9.3 and not more than 25 feet on center
First story of two story or second story of three story	X	X	X	X	X	X	X	X	
First story of three story	—	X	X	X	X	X	X	X	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
a. This table specifies minimum requirements for braced panels that form interior or exterior braced wall lines.
b. See Section 2308.9.3 for full description.
c. See Sections 2308.9.3.1 for alternative braced panel requirements.
d. Building length is the dimension parallel to the braced wall length.
e. Reserved.
f. Reserved.

TABLE 2308.9.3(2)
EXPOSED PLYWOOD PANEL SIDING

MINIMUM THICKNESS[a] (inch)	MINIMUM NUMBER OF PLIES	STUD SPACING (inches) Plywood siding applied directly to studs or over sheathing
3/8	3	16[b]
1/2	4	24

For SI: 1 inch = 25.4 mm.

a. Thickness of grooved panels is measured at bottom of grooves.

b. Spans are permitted to be 24 inches if plywood siding applied with face grain perpendicular to studs or over one of the following: (1) 1-inch board sheathing, (2) 7/16-inch wood structural panel sheathing or (3) 3/8–inch wood structural panel sheathing with strength axis (which is the long direction of the panel unless otherwise marked) of sheathing perpendicular to studs.

TABLE 2308.9.3(3)
WOOD STRUCTURAL PANEL WALL SHEATHING[b]
(Not Exposed to the Weather, Strength Axis Parallel or Perpendicular to Studs Except as Indicated Below)

MINIMUM THICKNESS (inch)	PANEL SPAN RATING	STUD SPACING (inches)		
		Siding nailed to studs	Nailable sheathing	
			Sheathing parallel to studs	Sheathing perpendicular to studs
5/16	12/0, 16/0, 20/0 Wall–16″ o.c.	16	—	16
3/8, 15/32, 1/2	16/0, 20/0, 24/0, 32/16 Wall–24″ o.c.	24	16	24
7/16, 15/32, 1/2	24/0, 24/16, 32/16 Wall–24″ o.c.	24	24[a]	24

For SI: 1 inch = 25.4 mm.

a. Plywood shall consist of four or more plies.

b. Blocking of horizontal joints shall not be required except as specified in Sections 2306.4 and 2308.12.4.

TABLE 2308.9.3(4)
ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING
(Not Exposed to the Weather, Long Dimension of the Panel Parallel or Perpendicular to Studs)

GRADE	THICKNESS (inch)	STUD SPACING (inches)	
		Siding nailed to studs	Sheathing under coverings specified in Section 2308.9.3 parallel or perpendicular to studs
M-S "Exterior Glue" and M-2"Exterior Glue"	3/8	16	—
	1/2	16	16

For SI: 1 inch = 25.4 mm.

TABLE 2308.9.3(5)
HARDBOARD SIDING

SIDING	MINIMUM NOMINAL THICKNESS (inch)	2 x 4 FRAMING MAXIMUM SPACING	NAIL SIZE[a,b,d]	NAIL SPACING	
				General	Bracing panels[c]
1. Lap siding					
Direct to studs	3/8	16″ o.c.	8d	16″ o.c.	Not applicable
Over sheathing	3/8	16″ o.c.	10d	16″ o.c.	Not applicable
2. Square edge panel siding					
Direct to studs	3/8	24″ o.c.	6d	6″ o.c. edges; 12″ o.c. at intermediate supports	4″ o.c. edges; 8″ o.c. at intermediate supports
Over sheathing	3/8	24″ o.c.	8d	6″ o.c. edges; 12″ o.c. at intermediate supports	4″ o.c. edges; 8″ o.c. at intermediate supports
3. Shiplap edge panel siding					
Direct to studs	3/8	16″ o.c.	6d	6″ o.c. edges; 12″ o.c. at intermediate supports	4″ o.c. edges; 8″ o.c. at intermediate supports
Over sheathing	3/8	16″ o.c.	8d	6″ o.c. edges; 12″ o.c. At intermediate supports	4″ o.c. edges; 8″ o.c. at intermediate supports

For SI: 1 inch = 25.4 mm.

a. Nails shall be corrosion resistant.

b. Minimum acceptable nail dimensions:

	Panel Siding (inch)	Lap Siding (inch)
Shank diameter	0.092	0.099
Head diameter	0.225	0.240

c. Where used to comply with Section 2308.9.3.

d. Nail length must accommodate the sheathing and penetrate framing 1 1/2 inches.

2308.10 Roof and ceiling framing. The framing details required in this section apply to roofs having a minimum slope of three units vertical in 12 units horizontal (25-percent slope) or greater. Where the roof slope is less than three units vertical in 12 units horizontal (25-percent slope), members supporting rafters and ceiling joists such as ridge board, hips and valleys shall be designed as beams.

2308.10.1 Wind uplift. Roof assemblies shall have rafter and truss ties to the wall below. Resultant uplift loads shall be transferred to the foundation using a continuous load path. The rafter or truss to wall connection shall comply with Tables 2304.9.1 and 2308.10.1.

2308.10.2 Ceiling joist spans. Allowable spans for ceiling joists shall be in accordance with Table 2308.10.2(1) or 2308.10.2(2). For other grades and species, refer to the *AF&PA Span Tables for Joists and Rafters*.

2308.10.3 Rafter spans. Allowable spans for rafters shall be in accordance with Table 2308.10.3(1), 2308.10.3(2), 2308.10.3(3), 2308.10.3(4), 2308.10.3(5) or 2308.10.3(6). For other grades and species, refer to the *AF&PA Span Tables for Joists and Rafters*.

Table 2308.10.3(3) Rafter Spans for Common Lumber Species (Ground Snow Load = 30 pounds per square foot, Ceiling Not Attached to Rafters, L/Δ = 180). Reserved.

Table 2308.10.3(4) Rafter Spans for Common Lumber Species. (Ground Snow Load = 50 pounds per square foot. Ceiling Not Attached to Rafters, L/Δ = 180). Reserved.

Table 2308.10.3(5) Rafter Spans for Common Lumber Species (Ground Snow Load = 30 pounds per square foot, Ceiling Attached to Rafters, L/Δ = 240). Reserved.

Table 2308.10.3(6) Rafter Spans for Common Lumber Species. (Ground Snow Load = 50 pounds per square foot. Ceiling Attached to Rafters, L/Δ = 240). Reserved.

2308.10.4 Ceiling joist and rafter framing. Rafters shall be framed directly opposite each other at the ridge. There shall be a ridge board at least 1-inch (25 mm) nominal thickness at ridges and not less in depth than the cut end of the rafter. At valleys and hips, there shall be a single valley or hip rafter not less than 2-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter.

2308.10.4.1 Ceiling joist and rafter connections. Ceiling joists and rafters shall be nailed to each other and the assembly shall be nailed to the top wall plate in accordance with Tables 2304.9.1 and 2308.10.1. Ceiling joists shall be continuous or securely joined where they meet over interior partitions and fastened to adjacent rafters in accordance with Tables 2308.10.4.1 and 2304.9.1 to provide a continuous rafter tie across the building where such joists are parallel to the rafters. Ceiling joists shall

TABLE 2308.9.5
HEADER AND GIRDER SPANS[a] FOR EXTERIOR BEARING WALLS
(Maximum Spans for Douglas Fir-Larch, Hem-Fir, Southern Pine and Spruce-Pine-Fir[b] and Required Number of Jack Studs)

HEADERS SUPPORTING	SIZE	Building width[c] (feet)					
		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
Roof & Ceiling	2-2 × 4	3-6	1	3-2	1	2-10	1
	2-2 × 6	5-5	1	4-8	1	4-2	1
	2-2 × 8	6-10	1	5-11	2	5-4	2
	2-2 × 10	8-5	2	7-3	2	6-6	2
	2-2 × 12	9-9	2	8-5	2	7-6	2
	3-2 × 8	8-4	1	7-5	1	6-8	1
	3-2 × 10	10-6	1	9-1	2	8-2	2
	3-2 × 12	12-2	2	10-7	2	9-5	2
	4-2 × 8	9-2	1	8-4	1	7-8	1
	4-2 × 10	11-8	1	10-6	1	9-5	2
	4-2 × 12	14-1	1	12-2	2	10-11	2
Roof Ceiling & 1 Center-Bearing Floor	2-2 × 4	3-1	1	2-9	1	2-5	1
	2-2 × 6	4-6	1	4-0	1	3-7	2
	2-2 × 8	5-9	2	5-0	2	4-6	2
	2-2 × 10	7-0	2	6-2	2	5-6	2
	2-2 × 12	8-1	2	7-1	2	6-5	2
	3-2 × 8	7-2	1	6-3	2	5-8	2
	3-2 × 10	8-9	2	7-8	2	6-11	2
	3-2 × 12	10-2	2	8-11	2	8-0	2
	4-2 × 8	8-1	1	7-3	1	6-7	1
	4-2 × 10	10-1	1	8-10	2	8-0	2
	4-2 × 12	11-9	2	10-3	2	9-3	2
Roof Ceiling & 1 Clear Span Floor	2-2 × 4	2-8	1	2-4	1	2-1	1
	2-2 × 6	3-11	1	3-5	2	3-0	2
	2-2 × 8	5-0	2	4-4	2	3-10	2
	2-2 × 10	6-1	2	5-3	2	4-8	2
	2-2 × 12	7-1	2	6-1	3	5-5	3
	3-2 × 8	6-3	2	5-5	2	4-10	2
	3-2 × 10	7-7	2	6-7	2	5-11	2
	3-2 × 12	8-10	2	7-8	2	6-10	2
	4-2 × 8	7-2	1	6-3	2	5-7	2
	4-2 × 10	8-9	2	7-7	2	6-10	2
	4-2 × 12	10-2	2	8-10	2	7-11	2

(continued)

TABLE 2308.9.5—continued
HEADER AND GIRDER SPANS[a] FOR EXTERIOR BEARING WALLS
(Maximum Spans for Douglas Fir-Larch, Hem-Fir, Southern Pine and Spruce-Pine-Fir[b] and Required Number of Jack Studs)

HEADERS SUPPORTING	SIZE	Building width[c] (feet)					
		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
Roof, Ceiling & 2 Center-Bearing Floors	2-2 × 4	2-7	1	2-3	1	2-0	1
	2-2 × 6	3-9	2	3-3	2	2-11	2
	2-2 × 8	4-9	2	4-2	2	3-9	2
	2-2 × 10	5-9	2	5-1	2	4-7	3
	2-2 × 12	6-8	2	5-10	3	5-3	3
	3-2 × 8	5-11	2	5-2	2	4-8	2
	3-2 × 10	7-3	2	6-4	2	5-8	2
	3-2 × 12	8-5	2	7-4	2	6-7	2
	4-2 × 8	6-10	1	6-0	2	5-5	2
	4-2 × 10	8-4	2	7-4	2	6-7	2
	4-2 × 12	9-8	2	8-6	2	7-8	2
Roof, Ceiling & 2 Clear Span Floors	2-2 × 4	2-1	1	1-8	1	1-6	2
	2-2 × 6	3-1	2	2-8	2	2-4	2
	2-2 × 8	3-10	2	3-4	2	3-0	3
	2-2 × 10	4-9	2	4-1	3	3-8	3
	2-2 × 12	5-6	3	4-9	3	4-3	3
	3-2 × 8	4-10	2	4-2	2	3-9	2
	3-2 × 10	5-11	2	5-1	2	4-7	3
	3-2 × 12	6-10	2	5-11	3	5-4	3
	4-2 × 8	5-7	2	4-10	2	4-4	2
	4-2 × 10	6-10	2	5-11	2	5-3	2
	4-2 × 12	7-11	2	6-10	2	6-2	3

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m^2.

a. Spans are given in feet and inches (ft-in).

b. Tabulated values are for No. 2 grade lumber.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Reserved.

TABLE 2308.9.6
HEADER AND GIRDER SPANS[a] FOR INTERIOR BEARING WALLS
(Maximum Spans for Douglas Fir-Larch, Hem-Fir, Southern Pine and Spruce-Pine-Fir[b] and Required Number of Jack Studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING WIDTH[c] (feet)					
		20		28		36	
		Span	NJ[d]	Span	NJ[d]	Span	NJ[d]
One Floor Only	2-2 × 4	3-1	1	2-8	1	2-5	1
	2-2 × 6	4-6	1	3-11	1	3-6	1
	2-2 × 8	5-9	1	5-0	2	4-5	2
	2-2 ×10	7-0	2	6-1	2	5-5	2
	2-2 ×12	8-1	2	7-0	2	6-3	2
	3-2 × 8	7-2	1	6-3	1	5-7	2
	3-2 ×10	8-9	1	7-7	2	6-9	2
	3-2 ×12	10-2	2	8-10	2	7-10	2
	4-2 × 8	9-0	1	7-8	1	6-9	1
	4-2 ×10	10-1	1	8-9	1	7-10	2
	4-2 ×12	11-9	1	10-2	2	9-1	2
Two Floors	2-2 × 4	2-2	1	1-10	1	1-7	1
	2-2 × 6	3-2	2	2-9	2	2-5	2
	2-2 × 8	4-1	2	3-6	2	3-2	2
	2-2 ×10	4-11	2	4-3	2	3-10	3
	2-2 ×12	5-9	2	5-0	3	4-5	3
	3-2 × 8	5-1	2	4-5	2	3-11	2
	3-2 ×10	6-2	2	5-4	2	4-10	2
	3-2 ×12	7-2	2	6-3	2	5-7	3
	4-2 × 8	6-1	1	5-3	2	4-8	2
	4-2 ×10	7-2	2	6-2	2	5-6	2
	4-2 ×12	8-4	2	7-2	2	6-5	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Spans are given in feet and inches (ft-in).

b. Tabulated values are for No. 2 grade lumber.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the headers are permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

TABLE 2308.10.1
REQUIRED RATING OF APPROVED UPLIFT CONNECTORS (pounds)[a,b,c,e,f,g,h]

BASIC WIND SPEED (3-second gust)	ROOF SPAN (feet)							OVERHANGS (pounds/feet)[d]
	12	20	24	28	32	36	40	
85	-72	-120	-145	-169	-193	-217	-241	-38.55
90	-91	-151	-181	-212	-242	-272	-302	-43.22
100	-131	-281	-262	-305	-349	-393	-436	-53.36
110	-175	-292	-351	-409	-467	-526	-584	-64.56

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.61 km/hr, 1 pound = 0.454 Kg, 1 pound/foot = 14.5939 N/m.

a. The uplift connection requirements are based on a 30-foot mean roof height located in Exposure B. For Exposure C or D and for other mean roof heights, multiply the above loads by the adjustment coefficients below.

	Mean Roof Height (feet)									
EXPOSURE	15	20	25	30	35	40	45	50	55	60
B	1.00	1.00	1.00	1.00	1.05	1.09	1.12	1.16	1.19	1.22
C	1.21	1.29	1.35	1.40	1.45	1.49	1.53	1.56	1.59	1.62
D	1.47	1.55	1.61	1.66	1.70	1.74	1.78	1.81	1.84	1.87

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection requirements include an allowance for 10 pounds of dead load.

d. The uplift connection requirements do not account for the effects of overhangs. The magnitude of the above loads shall be increased by adding the overhang loads found in the table. The overhang loads are also based on framing spaced 24 inches on center. The overhang loads given shall be multiplied by the overhang projection and added to the roof uplift value in the table.

e. The uplift connection requirements are based upon wind loading on end zones as defined in Figure 6-2 of ASCE 7. Connection loads for connections located a distance of 20 percent of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.7 and multiplying the overhang load by 0.8.

f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 500-pound rated connector is used on the roof framing, a 400-pound rated connector is permitted at the next floor level down).

g. Interpolation is permitted for intermediate values of basic wind speeds and roof spans.

h. The rated capacity of approved tie-down devices is permitted to include up to a 60-percent increase for wind effects where allowed by material specifications.

have a bearing surface of not less than $1^1/_2$ inches (38 mm) on the top plate at each end.

Where ceiling joists are not parallel to rafters, an equivalent rafter tie shall be installed in a manner to provide a continuous tie across the building, at a spacing of not more than 4 feet (1219 mm) o.c. The connections shall be in accordance with Tables 2308.10.4.1 and 2304.9.1, or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top of the rafter support walls, the ridge formed by these rafters shall also be supported by a girder conforming to Section 2308.4.

Rafter ties shall be spaced not more than 4 feet (1219 mm) o.c. Rafter tie connections shall be based on the equivalent rafter spacing in Table 2308.10.4.1. Where rafter ties are spaced at 32 inches (813 mm) o.c., the number of 16d common nails shall be two times the number specified for rafters spaced 16 inches (406 mm) o.c., with a minimum of 4-16d common nails where no snow loads are indicated. Where rafter ties are spaced at 48 inches (1219 mm) o.c., the number of 16d common nails shall be two times the number specified for rafters spaced 24 inches (610 mm) o.c., with a minimum of 6-16d common nails where no snow loads are indicated. Rafter/ceiling joist connections and rafter/tie connections shall be of sufficient size and number to prevent splitting from nailing.

2308.10.4.2 Notches and holes. Notching at the ends of rafters or ceiling joists shall not exceed one-fourth the depth. Notches in the top or bottom of the rafter or ceiling joist shall not exceed one-sixth the depth and shall not be located in the middle one-third of the span, except that a notch not exceeding one-third of the depth is permitted in the top of the rafter or ceiling joist not further from the face of the support than the depth of the member.

Holes bored in rafters or ceiling joists shall not be within 2 inches (51 mm) of the top and bottom and their diameter shall not exceed one-third the depth of the member.

2308.10.4.3 Framing around openings. Trimmer and header rafters shall be doubled, or of lumber of equivalent cross section, where the span of the header exceeds 4 feet (1219 mm). The ends of header rafters more than 6 feet (1829 mm) long shall be supported by framing anchors or rafter hangers unless bearing on a beam, partition or wall.

2308.10.5 Purlins. Purlins to support roof loads are permitted to be installed to reduce the span of rafters within allowable limits and shall be supported by struts to bearing walls. The maximum span of 2-inch by 4-inch (51 mm by 102 mm) purlins shall be 4 feet (1219 mm). The maximum span of the 2-inch by 6-inch (51 mm by 152 mm) purlin shall be 6 feet (1829 mm), but in no case shall the purlin be smaller than the supported rafter. Struts shall not be smaller than 2-inch by 4-inch (51 mm by 102 mm) members. The unbraced length of struts shall not exceed 8 feet (2438 mm) and the minimum slope of the struts shall not be less than 45 degrees (0.79 rad) from the horizontal.

TABLE 2308.10.2(1)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable Attics Without Storage, Live Load = 10 pounds psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 pounds per square foot			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	13-2	20-8	Note a	Note a
	Douglas Fir-Larch	#1	12-8	19-11	Note a	Note a
	Douglas Fir-Larch	#2	12-5	19-6	25-8	Note a
	Douglas Fir-Larch	#3	10-10	15-10	20-1	24-6
	Hem-Fir	SS	12-5	19-6	25-8	Note a
	Hem-Fir	#1	12-2	19-1	25-2	Note a
	Hem-Fir	#2	11-7	18-2	24-0	Note a
	Hem-Fir	#3	10-10	15-10	20-1	24-6
	Southern Pine	SS	12-11	20-3	Note a	Note a
	Southern Pine	#1	12-8	19-11	Note a	Note a
	Southern Pine	#2	12-5	19-6	25-8	Note a
	Southern Pine	#3	11-6	17-0	21-8	25-7
	Spruce-Pine-Fir	SS	12-2	19-1	25-2	Note a
	Spruce-Pine-Fir	#1	11-10	18-8	24-7	Note a
	Spruce-Pine-Fir	#2	11-10	18-8	24-7	Note a
	Spruce-Pine-Fir	#3	10-10	15-10	20-1	24-6
16	Douglas Fir-Larch	SS	11-11	18-9	24-8	Note a
	Douglas Fir-Larch	#1	11-6	18-1	23-10	Note a
	Douglas Fir-Larch	#2	11-3	17-8	23-0	Note a
	Douglas Fir-Larch	#3	9-5	13-9	17-5	21-3
	Hem-Fir	SS	11-3	17-8	23-4	Note a
	Hem-Fir	#1	11-0	17-4	22-10	Note a
	Hem-Fir	#2	10-6	16-6	21-9	Note a
	Hem-Fir	#3	9-5	13-9	17-5	21-3
	Southern Pine	SS	11-9	18-5	24-3	Note a
	Southern Pine	#1	11-6	18-1	23-1	Note a
	Southern Pine	#2	11-3	17-8	23-4	Note a
	Southern Pine	#3	10-0	14-9	18-9	22-2
	Spruce-Pine-Fir	SS	11-0	17-4	22-10	Note a
	Spruce-Pine-Fir	#1	10-9	16-11	22-4	Note a
	Spruce-Pine-Fir	#2	10-9	16-11	22-4	Note a
	Spruce-Pine-Fir	#3	9-5	13-9	17-5	21-3

(continued)

TABLE 2308.10.2(1)—continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable Attics Without Storage, Live Load = 10 pounds psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 pounds per square foot			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	11-3	17-8	23-3	Note a
	Douglas Fir-Larch	#1	10-10	17-0	22-5	Note a
	Douglas Fir-Larch	#2	10-7	16-7	21-0	25-8
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5
	Hem-Fir	SS	10-7	16-8	21-11	Note a
	Hem-Fir	#1	10-4	16-4	21-6	Note a
	Hem-Fir	#2	9-11	15-7	20-6	25-3
	Hem-Fir	#3	8-7	12-6	15-10	19-5
	Southern Pine	SS	11-0	17-4	22-10	Note a
	Southern Pine	#1	10-10	17-0	22-5	Note a
	Southern Pine	#2	10-7	16-8	21-11	Note a
	Southern Pine	#3	9-1	13-6	17-2	20-3
	Spruce-Pine-Fir	SS	10-4	16-4	21-6	Note a
	Spruce-Pine-Fir	#1	10-2	15-11	21-0	25-8
	Spruce-Pine-Fir	#2	10-2	15-11	21-0	25-8
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5
24	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note a
	Douglas Fir-Larch	#1	10-0	15-9	20-1	24-6
	Douglas Fir-Larch	#2	9-10	14-10	18-9	22-11
	Douglas Fir-Larch	#3	7-8	11-2	14-2	17-4
	Hem-Fir	SS	9-10	15-6	20-5	Note a
	Hem-Fir	#1	9-8	15-2	19-7	23-11
	Hem-Fir	#2	9-2	14-5	18-6	22-7
	Hem-Fir	#3	7-8	11-2	14-2	17-4
	Southern Pine	SS	10-3	16-1	21-2	Note a
	Southern Pine	#1	10-0	15-9	20-10	Note a
	Southern Pine	#2	9-10	15-6	20-1	23-11
	Southern Pine	#3	8-2	12-0	15-4	18-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5
	Spruce-Pine-Fir	#1	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#2	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#3	7-8	11-2	14-2	17-4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m^2.

a. Span exceeds 26 feet in length. Check sources for availability of lumber in lengths greater than 20 feet.

TABLE 2308.10.2(2)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable Attics With Limited Storage, Live Load = 20 pounds per square foot, $L/\Delta = 240$)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note a
	Douglas Fir-Larch	#1	10-0	15-9	20-1	24-6
	Douglas Fir-Larch	#2	9-10	14-10	18-9	22-11
	Douglas Fir-Larch	#3	7-8	11-2	14-2	17-4
	Hem-Fir	SS	9-10	15-6	20-5	Note a
	Hem-Fir	#1	9-8	15-2	19-7	23-11
	Hem-Fir	#2	9-2	14-5	18-6	22-7
	Hem-Fir	#3	7-8	11-2	14-2	17-4
	Southern Pine	SS	10-3	16-1	21-2	Note a
	Southern Pine	#1	10-0	15-9	20-10	Note a
	Southern Pine	#2	9-10	15-6	20-1	23-11
	Southern Pine	#3	8-2	12-0	15-4	18-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5
	Spruce-Pine-Fir	#1	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#2	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#3	7-8	11-2	14-2	17-4
16	Douglas Fir-Larch	SS	9-6	14-11	19-7	25-0
	Douglas Fir-Larch	#1	9-1	13-9	17-5	21-3
	Douglas Fir-Larch	#2	8-9	12-10	16-3	19-10
	Douglas Fir-Larch	#3	6-8	9-8	12-4	15-0
	Hem-Fir	SS	8-11	14-1	18-6	23-8
	Hem-Fir	#1	8-9	13-5	16-10	20-8
	Hem-Fir	#2	8-4	12-8	16-0	19-7
	Hem-Fir	#3	6-8	9-8	12-4	15-0
	Southern Pine	SS	9-4	14-7	19-3	24-7
	Southern Pine	#1	9-1	14-4	18-11	23-1
	Southern Pine	#2	8-11	13-6	17-5	20-9
	Southern Pine	#3	7-1	10-5	13-3	15-8
	Spruce-Pine-Fir	SS	8-9	13-9	18-1	23-1
	Spruce-Pine-Fir	#1	8-7	12-10	16-3	19-10
	Spruce-Pine-Fir	#2	8-7	12-10	16-3	19-10
	Spruce-Pine-Fir	#3	6-8	9-8	12-4	15-0

(continued)

TABLE 2308.10.2(2)—continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable Attics With Limited Storage, Live Load = 20 pounds per square foot, $L/\Delta = 240$)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-11	14-0	18-5	23-4
	Douglas Fir-Larch	#1	8-7	12-6	15-10	19-5
	Douglas Fir-Larch	#2	8-0	11-9	14-10	18-2
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8
	Hem-Fir	SS	8-5	13-3	17-5	22-3
	Hem-Fir	#1	8-3	12-3	15-6	18-11
	Hem-Fir	#2	7-10	11-7	14-8	17-10
	Hem-Fir	#3	6-1	8-10	11-3	13-8
	Southern Pine	SS	8-9	13-9	18-1	23-1
	Southern Pine	#1	8-7	13-6	17-9	21-1
	Southern Pine	#2	8-5	12-3	15-10	18-11
	Southern Pine	#3	6-5	9-6	12-1	14-4
	Spruce-Pine-Fir	SS	8-3	12-11	17-1	21-8
	Spruce-Pine-Fir	#1	8-0	11-9	14-10	18-2
	Spruce-Pine-Fir	#2	8-0	11-9	14-10	18-2
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8
24	Douglas Fir-Larch	SS	8-3	13-0	17-1	20-11
	Douglas Fir-Larch	#1	7-8	11-2	14-2	17-4
	Douglas Fir-Larch	#2	7-2	10-6	13-3	16-3
	Douglas Fir-Larch	#3	5-5	7-11	10-0	12-3
	Hem-Fir	SS	7-10	12-3	16-2	20-6
	Hem-Fir	#1	7-6	10-11	13-10	16-11
	Hem-Fir	#2	7-1	10-4	13-1	16-0
	Hem-Fir	#3	5-5	7-11	10-0	12-3
	Southern Pine	SS	8-1	12-9	16-10	21-6
	Southern Pine	#1	8-0	12-6	15-10	18-10
	Southern Pine	#2	7-8	11-0	14-2	16-11
	Southern Pine	#3	5-9	8-6	10-10	12-10
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	19-5
	Spruce-Pine-Fir	#1	7-2	10-6	13-3	16-3
	Spruce-Pine-Fir	#2	7-2	10-6	13-3	16-3
	Spruce-Pine-Fir	#3	5-5	7-11	10-0	12-3

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m^2.

a. Span exceeds 26 feet in length. Check sources for availability of lumber in lengths greater than 20 feet.

TABLE 2308.10.3(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof Live Load = 20 pounds per square foot, Ceiling Not Attached to Rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	11-6	18-0	23-9	Note a	Note a	11-6	18-0	23-5	Note a	Note a
	Douglas Fir-Larch	#1	11-1	17-4	22-5	Note a	Note a	10-6	15-4	19-5	23-9	Note a
	Douglas Fir-Larch	#2	10-10	16-7	21-0	25-8	Note a	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	10-10	17-0	22-5	Note a	Note a	10-10	17-0	22-5	Note a	Note a
	Hem-Fir	#1	10-7	16-8	21-10	Note a	Note a	10-3	14-11	18-11	23-2	Note a
	Hem-Fir	#2	10-1	15-11	20-8	25-3	Note a	9-8	14-2	17-11	21-11	25-5
	Hem-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	11-3	17-8	23-4	Note a	Note a	11-3	17-8	23-4	Note a	Note a
	Southern Pine	#1	11-1	17-4	22-11	Note a	Note a	11-1	17-3	21-9	25-10	Note a
	Southern Pine	#2	10-10	17-0	22-5	Note a	Note a	10-6	15-1	19-5	23-2	Note a
	Southern Pine	#3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-Pine-Fir	SS	10-7	16-8	21-11	Note a	Note a	10-7	16-8	21-9	Note a	Note a
	Spruce-Pine-Fir	#1	10-4	16-3	21-0	25-8	Note a	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	10-4	16-3	21-0	25-8	Note a	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note a	Note a	10-5	16-0	20-3	24-9	Note a
	Douglas Fir-Larch	#1	10-0	15-4	19-5	23-9	Note a	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	9-10	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	9-10	15-6	20-5	Note a	Note a	9-10	15-6	19-11	24-4	Note a
	Hem-Fir	#1	9-8	14-11	18-11	23-2	Note a	8-10	12-11	16-5	20-0	23-3
	Hem-Fir	#2	9-2	14-2	17-11	21-11	25-5	8-5	12-3	15-6	18-11	22-0
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	10-3	16-1	21-2	Note a	Note a	10-3	16-1	21-2	Note a	Note a
	Southern Pine	#1	10-0	15-9	20-10	25-10	Note a	10-0	15-0	18-10	22-4	Note a
	Southern Pine	#2	9-10	15-1	19-5	23-2	Note a	9-1	13-0	16-10	20-1	23-7
	Southern Pine	#3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5	Note a	9-8	14-10	18-10	23-0	Note a
	Spruce-Pine-Fir	#1	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

(continued)

TABLE 2308.10.3(1)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof Live Load = 20 pounds per square foot, Ceiling Not Attached to Rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	9-10	15-5	20-4	25-11	Note a	9-10	14-7	18-6	22-7	Note a
	Douglas Fir-Larch	#1	9-5	14-0	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	8-11	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	9-3	14-7	19-2	24-6	Note a	9-3	14-4	18-2	22-3	25-9
	Hem-Fir	#1	9-1	13-8	17-4	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	8-8	12-11	16-4	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	9-8	15-2	19-11	25-5	Note a	9-8	15-2	19-11	25-5	Note a
	Southern Pine	#1	9-5	14-10	19-7	23-7	Note a	9-3	13-8	17-2	20-5	24-4
	Southern Pine	#2	9-3	13-9	17-9	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern Pine	#3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-Pine-Fir	SS	9-1	14-3	18-9	23-11	Note a	9-1	13-7	17-2	21-0	24-4
	Spruce-Pine-Fir	#1	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas Fir-Larch	SS	9-1	14-4	18-10	23-4	Note a	8-11	13-1	16-7	20-3	23-5
	Douglas Fir-Larch	#1	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	8-7	13-6	17-10	22-9	Note a	8-7	12-10	16-3	19-10	23-0
	Hem-Fir	#1	8-4	12-3	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	7-11	11-7	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-11	14-1	18-6	23-8	Note a	8-11	14-1	18-6	22-11	Note a
	Southern Pine	#1	8-9	13-9	17-9	21-1	25-2	8-3	12-3	15-4	18-3	21-9
	Southern Pine	#2	8-7	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3
	Southern Pine	#3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9
	Spruce-Pine-Fir	SS	8-5	13-3	17-5	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m^2.

a. Span exceeds 26 feet in length. Check sources for availability of lumber in lengths greater than 20 feet.

TABLE 2308.10.3(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof Live Load = 20 pounds per square foot, Ceiling Not Attached to Rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note a	Note a	10-5	16-4	21-7	Note a	Note a
	Douglas Fir-Larch	#1	10-0	15-9	20-10	Note a	Note a	10-0	15-4	19-5	23-9	Note a
	Douglas Fir-Larch	#2	9-10	15-6	20-5	25-8	Note a	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	9-10	15-6	20-5	Note a	Note a	9-10	15-6	20-5	Note a	Note a
	Hem-Fir	#1	9-8	15-2	19-11	25-5	Note a	9-8	14-11	18-11	23-2	Note a
	Hem-Fir	#2	9-2	14-5	19-0	24-3	Note a	9-2	14-2	17-11	21-11	25-5
	Hem-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	10-3	16-1	21-2	Note a	Note a	10-3	16-1	21-2	Note a	Note a
	Southern Pine	#1	10-0	15-9	20-10	Note a	Note a	10-0	15-9	20-10	25-10	Note a
	Southern Pine	#2	9-10	15-6	20-5	Note a	Note a	9-10	15-1	19-5	23-2	Note a
	Southern Pine	#3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5	Note a	9-8	15-2	19-11	25-5	Note a
	Spruce-Pine-Fir	#1	9-5	14-9	19-6	24-10	Note a	9-5	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	9-5	14-9	19-6	24-10	Note a	9-5	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas Fir-Larch	SS	9-6	14-11	19-7	25-0	Note a	9-6	14-11	19-7	24-9	Note a
	Douglas Fir-Larch	#1	9-1	14-4	18-11	23-9	Note a	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	8-11	14-1	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	8-11	14-1	18-6	23-8	Note a	8-11	14-1	18-6	23-8	Note a
	Hem-Fir	#1	8-9	13-9	18-1	23-1	Note a	8-9	12-11	16-5	20-0	23-3
	Hem-Fir	#2	8-4	13-1	17-3	21-11	25-5	8-4	12-3	15-6	18-11	22-0
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	9-4	14-7	19-3	24-7	Note a	9-4	14-7	19-3	24-7	Note a
	Southern Pine	#1	9-1	14-4	18-11	24-1	Note a	9-1	14-4	18-10	22-4	Note a
	Southern Pine	#2	8-11	14-1	18-6	23-2	Note a	8-11	13-0	16-10	20-1	23-7
	Southern Pine	#3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-Pine-Fir	SS	8-9	13-9	18-1	23-1	Note a	8-9	13-9	18-1	23-0	Note a
	Spruce-Pine-Fir	#1	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

(continued)

TABLE 2308.10.3(2)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
(Roof Live Load = 20 pounds per square foot, Ceiling Not Attached to Rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 pounds per square foot					DEAD LOAD = 20 pounds per square foot				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-11	14-0	18-5	23-7	Note a	8-11	14-0	18-5	22-7	Note a
	Douglas Fir-Larch	#1	8-7	13-6	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	8-5	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	8-5	13-3	17-5	22-3	Note a	8-5	13-3	17-5	22-3	25-9
	Hem-Fir	#1	8-3	12-11	17-1	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	7-10	12-4	16-3	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	8-9	13-9	18-1	23-1	Note a	8-9	13-9	18-1	23-1	Note a
	Southern Pine	#1	8-7	13-6	17-9	22-8	Note a	8-7	13-6	17-2	20-5	24-4
	Southern Pine	#2	8-5	13-3	17-5	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern Pine	#3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-Pine-Fir	SS	8-3	12-11	17-1	21-9	Note a	8-3	12-11	17-1	21-0	24-4
	Spruce-Pine-Fir	#1	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas Fir-Larch	SS	8-3	13-0	17-2	21-10	Note a	8-3	13-0	16-7	20-3	23-5
	Douglas Fir-Larch	#1	8-0	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	7-10	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-10	23-0
	Hem-Fir	#1	7-8	12-0	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	7-3	11-5	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-1	12-9	16-10	21-6	Note a	8-1	12-9	16-10	21-6	Note a
	Southern Pine	#1	8-0	12-6	16-6	21-1	25-2	8-0	12-3	15-4	18-3	21-9
	Southern Pine	#2	7-10	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3
	Southern Pine	#3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m^2.

a. Span exceeds 26 feet in length. Check sources for availability of lumber in lengths greater than 20 feet.

TABLE 2308.10.4.1
RAFTER TIE CONNECTIONS[g]

RAFTER SLOPE	TIE SPACING (inches)	ROOF SPAN (FEET)			
		12	20	28	36
		Required number of 16d common ($3^1/_2$" x 0.162") nails[a,b] per connection[c,d,e,f]			
3:12	12	4	6	8	10
	16	5	7	10	13
	24	7	11	15	19
	32	10	14	19	25
	48	14	21	29	37
4:12	12	3	4	5	6
	16	3	5	7	8
	24	4	7	10	12
	32	6	9	13	16
	48	8	14	19	24
5:12	12	3	3	4	5
	16	3	4	5	7
	24	4	6	8	10
	32	5	8	10	13
	48	7	11	15	20
7:12	12	3	3	3	4
	16	3	3	4	5
	24	3	4	6	7
	32	4	6	8	10
	48	5	8	11	14
9:12	12	3	3	3	3
	16	3	3	3	4
	24	3	3	5	6
	32	3	4	6	8
	48	4	6	9	11
12:12	12	3	3	3	3
	16	3	3	3	3
	24	3	3	3	4
	32	3	3	4	5
	48	3	4	6	7

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m^2.

a. 40d box (5" × 0.162") or 16d sinker ($3^1/_4$" × 0.148") nails are permitted to be substituted for 16d common ($3^1/_2$" × 0.16") nails.

b. Nailing requirements are permitted to be reduced 25 percent if nails are clinched.

c. Rafter tie heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.

d. When intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements are permitted to be reduced proportionally to the reduction in span.

e. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

f. Connected members shall be of sufficient size to prevent splitting due to nailing.

g. Reserved.

2308.10.6 Blocking. Roof rafters and ceiling joists shall be supported laterally to prevent rotation and lateral displacement in accordance with the provisions of Section 2308.8.5.

2308.10.7 Engineered wood products. Prefabricated wood I-joists, structural glued-laminated timber and structural composite lumber shall not be notched or drilled except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

2308.10.8 Roof sheathing. Roof sheathing shall be in accordance with Tables 2304.7(3) and 2304.7(5) for wood structural panels, and Tables 2304.7(1) and 2304.7(2) for lumber and shall comply with Section 2304.7.2.

2308.10.8.1 Joints. Joints in lumber sheathing shall occur over supports unless approved end-matched lumber is used, in which case each piece shall bear on at least two supports.

2308.10.9 Roof planking. Planking shall be designed in accordance with the general provisions of this code.

In lieu of such design, 2-inch (51 mm) tongue-and-groove planking is permitted in accordance with Table 2308.10.9. Joints in such planking are permitted to be randomly spaced, provided the system is applied to not less than three continuous spans, planks are center matched and end matched or splined, each plank bears on at least one support, and joints are separated by at least 24 inches (610 mm) in adjacent pieces.

2308.10.10 Wood trusses. Wood trusses shall be designed in accordance with Section 2303.4.

2308.10.11 Attic ventilation. For attic ventilation, see Section 1203.2.

2308.11 Additional requirements for conventional construction in Seismic Design Category B or C. Reserved.

2308.11.1 Number of stories. Reserved.

2308.11.2 Concrete or masonry. Reserved.

2308.11.3 Framing and connection details. Reserved.

2308.11.3.1 Anchorage. Reserved.

2308.11.3.2 Stepped footings. Reserved.

2308.11.3.3 Openings in horizontal diaphragms. Reserved.

2308.12 Additional requirements for conventional construction in Seismic Design Category D or E. Reserved.

TABLE 2308.10.9
ALLOWABLE SPANS FOR 2-INCH TONGUE-AND-GROOVE DECKING

SPAN[a] (feet)	LIVE LOAD (pound per square foot)	DEFLECTION LIMIT	BENDING STRESS (f) (pound per square inch)	MODULUS OF ELASTICITY (E) (pound per square inch)
Roofs				
4	20	1/240 1/360	160	170,000 256,000
	30	1/240 1/360	210	256,000 384,000
	40	1/240 1/360	270	340,000 512,000
4.5	20	1/240 1/360	200	242,000 305,000
	30	1/240 1/360	270	363,000 405,000
	40	1/240 1/360	350	484,000 725,000
5.0	20	1/240 1/360	250	332,000 500,000
	30	1/240 1/360	330	495,000 742,000
	40	1/240 1/360	420	660,000 1,000,000
5.5	20	1/240 1/360	300	442,000 660,000
	30	1/240 1/360	400	662,000 998,000
	40	1/240 1/360	500	884,000 1,330,000
6.0	20	1/240 1/360	360	575,000 862,000
	30	1/240 1/360	480	862,000 1,295,000
	40	1/240 1/360	600	1,150,000 1,730,000
6.5	20	1/240 1/360	420	595,000 892,000
	30	1/240 1/360	560	892,000 1,340,000
	40	1/240 1/360	700	1,190,000 1,730,000
7.0	20	1/240 1/360	490	910,000 1,360,000
	30	1/240 1/360	650	1,370,000 2,000,000
	40	1/240 1/360	810	1,820,000 2,725,000

(continued)

TABLE 2308.10.9–continued
ALLOWABLE SPANS FOR 2-INCH TONGUE-AND-GROOVE DECKING

SPAN[a] (feet)	LIVE LOAD (pound per square foot)	DEFLECTION LIMIT	BENDING STRESS (f) (pound per square inch)	MODULUS OF ELASTICITY (E) (pound per square inch)
Roofs				
7.5	20	1/240 1/360	560	1,125,000 1,685,000
	30	1/240 1/360	750	1,685,000 2,530,000
	40	1/240 1/360	930	2,250,000 3,380,000
8.0	20	1/240 1/360	640	1,360,000 2,040,000
	30	1/240 1/360	850	2,040,000 3,060,000
Floors				
4 4.5 5.0	40	1/360	840 950 1,060	1,000,000 1,300,000 1,600,000

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m^2, 1 pound per square inch = 0.00689 N/mm^2.

a. Spans are based on simple beam action with 10 pounds per square foot dead load and provisions for a 300-pound concentrated load on a 12-inch width of decking. Random layup is permitted in accordance with the provisions of Section 2308.10.9. Lumber thickness is $1\frac{1}{2}$ inches nominal.

SECTIONS 2309 - 2313
RESERVED

SECTION 2314
HIGH-VELOCITY HURRICANE ZONES

2314.1 Design. Wood members and their fastenings shall be designed to comply with this code by methods based on rational analysis or approved laboratory testing procedures, both performed in accordance with fundamental principles of theoretical and applied mechanics.

2314.2 Workmanship. Wood members shall be framed, anchored, tied and braced to develop the strength and rigidity necessary for the purposes for which they are used and to resist the loads imposed as set forth in this code. Wood construction shall be in conformance with the tolerances, quality and methods of construction as prescribed by the standards in Chapter 35 of this code.

2314.3 Fabrication.

2314.3.1 Preparation, fabrication and installation of wood members and the glues, connectors and mechanical devices for fastening shall conform to good engineering practice.

2314.3.2 Any person desiring to manufacture or fabricate wood truss assemblies shall obtain a certificate of competency from the authority having jurisdiction.

2314.4 The following Standards, as set forth in Chapter 35 of this code, are hereby adopted for the design and quality of wood members and their fastenings:

2314.4.1 American Hardboard Products Association 887-B Wilmette Road,
Palatine, IL 60067 AHA

1. Basic Hardboard ANSI/AHA A135.4-1982
2. Prefinished Hardboard Paneling ANSI/AHA A135.5-1982
3. Hardboard Siding ANSI/AHA A135.6-1990
4. Cellulosic Fiberboard ANSI/AHA A194.1-1985
5. Recommended Product and Application Specification - Structural Insulating RoofDeck, I.B. Spec. No. 1
6. Recommended Product and Application Specification - $\frac{1}{2}$ inch Fiberboard Nail-Base-Sheathing I.B. Spec. No. 2
7. Recommended Product and Application Specification - $\frac{1}{2}$ inch Intermediate Fiberboard Sheathing I.B. Spec. No. 3

2314.4.2 American Institute of Timber Construction 333 West Hampden Avenue, Englewood, CO 80110 AITC

1. Typical Construction Details, AITC 104
2. Code of Suggested Practices, AITC 106
3. Standard for Heavy Timber Construction, AITC 108
4. Standard for Preservative Treatment for Structural Glued Laminated Timber, AITC 109
5. Standard Appearance Grades for Structural Glued Laminated Timber, AITC 110
6. Standard for Tongue and Groove Heavy Timber Roof Decking, AITC 112
7. Standard for Dimensions of Glued Laminated Structural Members, AITC 113
8. Standard Specifications for Structural Glued Laminated Timber of Softwood Species, AITC 117
9. Standard Specifications for Hardwood Glued Laminated Timber, AITC 119
10. Technical Report No. 7, Calculation of Fire Resistance of Glued Laminated Timber
11. Structural Glued Laminated Timber, ANSI/AITC A190.1

2314.4.3 APA The Engineered Wood Association (Formerly APA American Plywood Association) P.O. Box 11700, Tacoma, WA 98411

1. APA Design Construction Guide, Residential and Commercial E30D
2. Plywood Design Specification Y510J
3. Plywood Design Specification-Design and Fabrication of Plywood Beams Supplement No. 1 S811
4. Plywood Design Specification-Design and Fabrication of Plywood Beams Supplement No. 2 S812
5. Plywood Design Specification-Design and Fabrication of Plywood Stressed-Skin Panels Supplement No. 3 U813
6. Plywood Design Specifications-Design and Fabrication of Plywood Sandwich Panels Supplement No. 4 U814
7. Plywood Design Specifications-Design and Fabrication of All-Plywood Beams. Supplement No. 5 H815
8. Plywood Folded Plate, Laboratory Report 21 V910
9. APA Design/Construction Guide Diaphragms L350
10. Performance Standards and Policies for Structural-Use Panels PRP-108
11. 303 Siding Manufacturing Specifications B840

2314.4.4 American Society for Testing Materials 1916 Race Street, Philadelphia, PA 19103-1187 ASTM

1. Standard Test Methods for Mechanical Fasteners in Wood D 1761
2. Accelerated Weathering on Fire-Retardant Treated Wood for fire testing D 2898
3. Surface Burning Characteristics of Building Materials E 84
4. Hygroscopic Properties of Fire-Retardant Wood and Wood-Base Products D 3201
5. Standard Specifications for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems D 3498

2314.4.5 American Wood Preservers Association P.O. Box 5283, Springfield, VA 22150 AWPA

1. All Timber Products - Pressure Treatment (General Requirements) C1
2. Lumber, Timbers, Bridge Ties & Mine Ties Pressure Requirements C2
3. Piles - Pressure Treatment C3
4. Poles - Pressure Treatment C4
5. Care of Pressure Treated Wood Products M4
6. Posts - Pressure Treatment C5
7. Crossties and Switch Ties -Pressure Treatment C6
8. Incised (Red, White & Alaska Yellow Cedar) Poles Butts Thermal Treatment C7
9. Poles (Western Red & Alaska Yellow Cedar) Full Length Thermal Treatment C8
10. Plywood - Pressure Treatment C9
11. Poles (Lodgepole Pine) Full Length Thermal Treatment C10
12. Wood Blocks for Floors & Platforms Pressure Treatment C11
13. Wood for Highway Construction Pressure Treatment C14
14. Wood used on Farms - Pressure Treatment C16
15. Piles and Timbers in Marine Construction Pressure Treatment C18
16. Structural Lumber - Fire Retardant -Pressure Treatment C20
17. Lumber and Plywood for Permanent Wood Foundations C22
18. Pole Building Construction - Pressure Treatment C Section 23
19. Crossarms - Pressure Treatment C25
20. Crossarms - Non-Pressure Treatment C26
21. Structural Glued Laminated Members & Laminations Before Gluing Pressure Treatment C28
22. Lumber to be Used for the Harvesting, Storage and Transportation of Food Stuffs - Pressure Treatment C29

2314.4.6 National Institute for Standards and Technology Standard Development Services Section, Standards Application and Analysis Division, Washington, D.C. 20234 NIST

1. Mat-Formed Particleboard CS236
2. Structural Glued Laminated Timber PS56
3. Construction and Industrial Plywood PS1
4. American Softwood Lumber Standard PS20
5. Performance Standard for Wood Based Structural Use Panels PS2{*}
   {*} All wood-based structural panels except plywood shall have Product Approval and shall be tested in accordance with High-Velocity Hurricane Zone Testing Protocols.

2314.4.7 American Forest and Paper Association, 1111 19 Street NW, Washington, D.C. 20036

1. ANSI/AF&PA National Design Specification for Wood Construction, 2001
2. ANSI/AF&PA Design Values for Wood Construction, 2001
3. Wood Structural Design Data, 1992
4. Span Tables for Joists and Rafters, 1993
5. Working Stresses for Joists and Rafters, 1993
6. Wood Construction Data No. 1, Details for Conventional Wood Frame Construction, 2001
7. Wood Construction Data No. 4, Plank-and-Beam Framing for Residential Building, 1989
8. Wood Construction Data No. 5, Heavy Timber Construction Details, 1989
9. Wood Construction Data No. 6, Design of Wood Frame Structures for Permanence, 1988

10. Technical Report No. 7, The Permanent Wood Foundation System, 1987
11. ANSI/AF&PA WFCM-2001, Wood Frame Construction Manual for one and Two-Family Dwellings, 2001
12. All-Weather Wood Foundation System, Design, Fabrication, Installation Manual, 1987
13. Technical Report No. 7, All-Weather Wood Foundation System Basic Requirements with Supplements, 1987

2314.4.8 Timber Company, Inc. 2402 Daniels Street, Madison, WI 53704

TECO Performance Standards and Policies for Structural use Panels. PRP-133

2314.4.9 Truss Plate Institute.
218 N. Lee Street, Suite 312, Alexandria, VA 22314

1. *National Design Standard for Metal Plate Connected Wood Truss Construction* (Excluding Chapter 2).
2. Building Component Safety Information (BCSI 1) *Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses* [A joint publication with the Wood Truss Council of America (WTCA)].

2314.4.10 Underwriters Laboratories, Inc.
333 Pfingsten Road, Northbrook, IL 60062

Test Methods for Fire Resistance of UL-790 Roof Covering Materials

SECTION 2315
HIGH-VELOCITY HURRICANE ZONES — QUALITY

2315.1 Identification. All lumber used structurally, including end-jointed lumber, shall be identified by the grade mark of a lumber grading or inspection bureau or agency approved by the Board of Review of the American Lumber Standards Committee or the Canadian Lumber Standards Administrative Board: except that precut material, rough-sawn lumber and lumber thicker than 2 inches (51 mm) may be covered by a certificate of inspection in lieu of grade marking. The glued joints in end-jointed lumber, when used for load supporting purposes, shall be certified to be in accordance with the appropriate grading rules.

2315.1.1 Structural glued-laminated timber shall be manufactured and identified as required in ANSI/AITC 190.1 as adopted in Section 2314.4.

2315.1.2 All wood-based structural panels used structurally, including siding, roof sheathing, wall sheathing, floor sheathing, diaphragms and built-up members, shall be identified for grade and exposure level by the grade stamp of an approved testing and grading agency indicating conformance with PS-1, PS-2, APA PRP-108 or TECO PRP-133 as adopted in Section 2314.4.

2315.1.3 Wood shingles and/or shakes shall be identified by the grademark of an approved grading or inspection bureau or agency.

2315.1.4 Fiberboard for its various uses shall conform to ANSI/AHA A 194.1.

2315.1.5 Hardboard shall conform to AHA Standards as adopted in Section 2314.4, and shall be identified as to classification.

2315.1.6 Particleboard shall conform to the *Mat-Formed Particleboard Standard,* NIST CS Section 236, as adopted in Section 2314.4.6, and shall be identified by the grade mark or certificate of inspection issued by an approved agency.

2315.1.7 All lumber and wood-based structural panels required to be fire retardant treated shall bear permanent identification showing the fire performance rating thereof issued by an approved testing agency having a follow-up service. When exposed to the weather the material shall be permanently identified as suitable for such use in accordance with Section 2327.4. When exposed to sustained high humidity, the material shall be permanently identified as a low hygroscopic type suitable for interior use. Allowable design values, including connection design values, for lumber, glued laminated timber and wood-based structural panels, pressure treated with fire retardant chemicals shall be obtained from the company providing the treatment and redrying services. Listing of allowable design values shall be submitted and approved by the certification agency.

2315.1.8 All lumber, sawn timber, wood-based structural panels and poles supporting permanent structures and required by this code to be pressure treated and as described in the AWPA standards shall bear the quality mark of an approved inspection agency which maintains continued supervision, testing and inspection over the product. Agencies shall be accredited in accordance with the procedures of the American Lumber Standard (PS 20) or approved equivalent.

2315.1.9 Pressure-treated poles shall be branded in accordance with AWPA Standard M6 at the treating facility.

2315.1.10 The quality mark shall contain, as a minimum, the following information:

1. The treating company and plant location.
2. The AWPA standard to which the product is treated.
3. The trademark of an approved inspection agency which maintains continued supervision, testing and inspection over the quality of the product as described in the AWPA standards.
4. The preservative used.
5. The amount of retention of the chemical per cubic foot of wood.
6. If applicable, the method of drying after treatment.
7. The purpose for which the wood has been treated: ground contact, above ground or foundation.

   Exception: When the size of individual pieces, e.g. lumber less than 1 inch (25 mm) in nominal thickness, or lumber less than nominal 1 inch by 5 inches (25 mm by 127 mm) or 2 inches by 4 inches (25 mm by 127 mm), or lumber 36 inches (914 mm) and shorter,

except that $^5/_4$ by 4 shall be quality marked, prevents application of full legible marks, the quality mark shall be applied by stamping the faces of exterior pieces or by end labeling not less than 2 percent of the pieces of a bundled unit.

2315.1.11 All wood-based structural panels, including those made of fiberboard, hardboard and particleboard shall have Product Approval. Product Approval shall be given upon certification by an approved independent testing laboratory that the product:

1. Complies with the applicable standards set forth above.
2. The product complies with the manufacturer's published design properties before and after a wet-dry, wet-dry cycle.
3. The product when tested dry maintains a safety factor of 2:1 and when tested after the cycles specified in Section 2315.1.11(2) above maintains a safety factor of 1.5:1. Testing shall be as specified in the testing protocol.

2315.2 Wood-based structural panels permanently exposed in outdoor locations shall be rated for exterior use. When used for roof sheathing exposed to the outdoors on the underside or used structurally for wall, floor or roof cladding or for diaphragms, the panels shall be rated for Exposure 1 or exterior use.

2315.3 All lumber 2 inches (51 mm) or less in thickness shall contain not more than 19 percent moisture at the time of permanent incorporation in a building or structure and/or at the time of treatment with a wood preservative.

2315.4 Grade and species.

2315.4.1 All structural wood members not limited by other sections of this chapter shall be of sufficient size and capacity to carry all loads as required by the high-velocity hurricane provisions of Chapter 16 without exceeding the allowable design stresses specified in the *National Design Specification for Wood Construction* and in compliance with Section 2317.

2315.4.2 Lumber boards used for floor and roof sheathing shall be in accordance with Table 2315.4.2

TABLE 2315.4.2
MINIMUM GRADE REQUIREMENTS: BOARD GRADES

FLOOR OR ROOF SHEATHING	GRADING RULES
Utility	NLGA, WCLIB or WWPA
No. 4 Common or Utility	NLGA, WCLIB, WWPA, NHPMA or NELMA
No. 3	SPIB
Merchantable	RIS

SECTION 2316
HIGH-VELOCITY HURRICANE ZONES — SIZES

2316.1 Sizes of lumber, structural glued-laminated timber and plywood and other wood-based structural panels referred to in this code are nominal sizes.

2316.2 Computations to determine the required sizes of members shall be based on net dimensions (actual sizes).

SECTION 2317
HIGH-VELOCITY HURRICANE ZONES — UNIT STRESSES

2317.1 General.

2317.1.1 Lumber used for joists, rafters, trusses, columns, beams and/or other structural members shall be of no less strength than No. 2 grade of Southern Pine, Douglas Fir-Larch, Hem-Fir or Spruce-Pine-Fir. Joists and rafters shall be sized according to AF&PA Span Tables for Joists and Rafters adopted in Section 2314.4.

2317.1.2 Lumber used for studs in exterior walls and interior bearing walls shall be of no less strength than stud grade of Southern Pine, Douglas Fir-Larch, Hem-Fir or Spruce-Pine-Fir and capable of resisting all loads determined in accordance with Chapter 16 (High-Velocity Hurricane Zones). The unbraced height of the wall shall be no more than 8 feet 6 inches (2.6 m) (including top and bottom plates). Heights may be increased where justified by rational analysis prepared by a registered professional engineer or registered architect proficient in structural design.

2317.1.3 Lumber used for studs in interior non-bearing walls shall have a modulus of elasticity of no less than 0.9×10^6 pounds per square inch.

2317.1.4 The designer shall specify on the design drawings the size, spacing, species and grade of all load supporting members.

2317.2 Allowable stress design value may be modified for repetitive, duration, etc., factors where design is by a registered professional engineer or registered architect proficient in structural design or where such modified values are reflected in the tables of the standards in Section 2314.4.

SECTION 2318
HIGH-VELOCITY HURRICANE ZONE — VERTICAL FRAMING

2318.1 Studs in bearing and exterior walls. Studs in walls framing over 8 feet 6 inches (2.6 m) (including top and bottom plates) or supporting floor and roof loads shall be designed by rational analysis prepared by a registered professional engineer or registered architect proficient in structural design.

2318.1.1 Minimum size. Studs shall be not less than 2 inch by 6 inch for exterior walls or 2 inch by 4 inch (51 mm by 102 mm) for interior bearing or load resisting walls unless designed by rational analysis by a registered professional engineer or registered architect proficient in structural design.

2318.1.2 Spacing. Studs shall be spaced not more than 16 inches (406 mm) on center unless designed by rational analysis as a system of columns and beams by a registered professional engineer or registered architect proficient in structural design.

2318.1.3 Placing.

2318.1.3.1 Studs in exterior and bearing walls shall be placed with the longer dimension perpendicular to the wall.

2318.1.3.2 Studs in exterior walls and in bearing walls shall be supported by foundation plates, sills, or girders or floor framing directly over supporting walls or girders. Stud bearing walls when perpendicular to supporting joists may be offset from supporting walls or girders not more than the depth of the joists unless such joists are designed for the extra loading conditions.

2318.1.3.3 Stud walls framing into base plates of exterior walls and interior bearing walls resting on masonry or concrete shall be anchored past the plate to the masonry or concrete, or shall be anchored to a sill plate which is anchored in accordance with Section 2318.1.4.1 when the net wind uplift is up to 300 pounds per foot (4378 N/m).

2318.1.4 Sills and/or base plates.

2318.1.4.1 Sills and/or base plates, where provided in contact with masonry or concrete, shall be of an approved durable species or be treated with an approved preservative and shall be attached to the masonry or concrete with $^1/_2$ inch (13 mm) diameter bolts with oversized washer spaced not over 2 feet (610 mm) apart and embedded not less than 7 inches (178 mm) into a grout filled cell of masonry or into concrete. Base plates shall be placed in a recess $^3/_4$ inch (19 mm) deep and the width of the base plate at the edge of a concrete slab, beam/slab or any other type of construction which uses a masonry surface or concrete slab, or be provided with an alternate waterstop method as approved by the building official. Alternate methods of anchorage may be designed by rational analysis by a registered professional engineer or a registered architect proficient in structural design.

2318.1.4.2 Where the base plate of a bearing wall is supported on joists or trusses running perpendicular to the wall and the studs from the wall above do not fall directly over a joist or truss, a double base plate or a single base plate supported by a minimum 2 inch by 4 inch (51 mm by 102 mm) inset ribbon shall be used to support the upper stud wall.

2318.1.5 Top plates.

2318.1.5.1 The top plate of stud bearing walls shall be doubled and lapped at each intersection of walls and partitions.

2318.1.5.2 Joints shall be lapped not less than 4 feet (1219 mm).

2318.1.6 Corners. Corners of stud walls and partitions shall be framed solid by not less than three studs.

2318.1.7 Splicing. Studs, other than end-jointed lumber, shall be spliced only at points where lateral support is provided.

2318.1.8 Framing types.

2318.1.8.1 Wood framing may be any one, or a combination of, the following types: platform, balloon, plank and beam or pole type.

2318.1.8.2 Exterior stud walls of two-story buildings shall be balloon-framed with studs continuous from foundation to second floor ceiling and with second floor joists supported as indicated in Section 2319.3.3. Gable end walls in wood frame buildings shall be balloon framed with studs continuous from foundation to roof.

Exception: Platform framing is allowed in buildings over one story in height provided an additional mandatory inspection for floor level connectors is made before the framing/firestopping inspection. Gable end walls shall be balloon framed with studs continuous from top floor to roof.

2318.1.9 Notching.

2318.1.9.1 Studs that carry loads in excess of 75 percent of their capacity shall not be notched or cut.

2318.1.9.2 Studs that carry loads 75 percent or less of their capacity may be notched to one-third of the depth without limit of the number of consecutive studs.

2318.1.10 Pipes in walls.

2318.1.10.1 Stud walls and partitions containing pipes shall be framed to give proper clearance for the piping.

2318.1.10.2 Where walls and partitions containing piping are parallel to floor joists, the joists shall be doubled and may be spaced to allow vertical passage of pipes.

2318.1.10.3 Where vertical pipe positions necessitate the cutting of plates, a metal tie not less than 1 inch by $^1/_8$ inch (25 mm by 3 mm) shall be placed on each side of the plate across the opening and nailed with not less than two 16d or three 8d nails at each end.

2318.1.11 Headers.

2318.1.11.1 All headers in bearing walls shall be designed by rational analysis.

2318.1.11.2 Headers or lintels over stud wall openings shall have not less than nominal 2-inch (51 mm) bearings.

2318.1.12 Studs joining masonry or reinforced concrete walls. Where stud walls or partitions join masonry or concrete walls, such studs shall be secured against lateral movement by bolting to the masonry or concrete with $^1/_2$ inch (13 mm) diameter anchor bolts with oversized washer spaced not more than 4 feet (1219 mm) apart and embedded not less than 5 inches (127 mm) into a grout filled cell or into concrete or as designed by a registered professional engineer or registered architect proficient in structural design using rational analysis.

2318.1.13 Wind bracing. Exterior stud walls shall be effectively wind-braced in accordance with Section 2322.3.

Such bracing shall be designed by a registered professional engineer or registered architect proficient in structural design.

2318.1.14 The intermixing of wall framing described in this chapter with other types of structural wall systems as provided in this code shall not be permitted unless such wall framing and connections are designed by a registered professional engineer or registered architect proficient in structural design.

2318.1.15 Wall hung fixtures. Studs in bearing walls, exterior walls and nonbearing partitions supporting wall hung plumbing fixtures and wall cabinets shall be not less than 2x4, where spaced not more than 16 inches (406 mm) on center or, not less than 2 inch by 6 inch (51 mm by 152 mm), where spaced not more than 24 inches (610 mm) on center.

2318.1.15.1 A minimum 2-inch by 4-inch (51 mm by 104 mm) horizontal wood member, securely fastened to not less than two such studs, shall be installed for the attachment of each wall hung plumbing fixture and wall cabinet.

2318.2 Interior nonbearing partitions.

2318.2.1 Studs in interior nonbearing partitions shall be of not less than 2 inch by 4 inch (51 mm by 104 mm) spaced not more than 24 inches (610 mm) o.c.

2318.2.2 Interior nonbearing stud partitions may have a single top plate.

2318.2.3 Headers over openings not exceeding 4 feet (1219 mm) in width may be of 2-inch (51 mm) nominal thickness placed flat and end-nailed through the studs with no solid bearing provided.

2318.2.4 Studs in interior nonbearing partitions shall be placed with the longer dimension perpendicular to the partition.

2318.2.5 Stud partitions subject to frequent wetting shall be of pressure treated wood or shall be protected with 15-pound asphalt-saturated felt, or by other approved design methods.

2318.2.6 Wardrobe units serving as nonbearing partitions, prefabricated or partially prefabricated may be of 2-inch by 2-inch (51 mm by 51 mm) studs spaced not farther apart than 16 inches (406 mm) provided there is a wood-based structural panel skin-glued or nailed to the studs.

2318.3 Columns and posts.

2318.3.1 Columns and posts shall be framed to true end bearing, shall be securely anchored against lateral and vertical forces, and shall be designed by a registered professional engineer or registered architect proficient in structural design.

2318.3.2 The bottom of columns and posts shall be protected against deterioration by an approved product or method.

2318.3.3 Columns and posts shall be spliced only in regions where lateral support is adequately provided about both axes and is designed by rational analysis. Such design shall be prepared, signed and sealed by a registered professional engineer or registered architect proficient in structural design.

2318.3.4 Design dimensions of columns and posts shall not be reduced by notching, cutting or boring.

SECTION 2319
HIGH-VELOCITY HURRICANE ZONES – HORIZONTAL FRAMING

2319.1 Size.

2319.1.1 The minimum size of joists and rafters shall be as set forth in Section 2317.

2319.1.2 The design of horizontal framing other than joists and rafters shall be as set forth in Section 2317.1.1.

2319.1.3 Horizontal wood members independently supporting a suspended ceiling shall be not less than 2-inch by 4-inch (51 mm by 102 mm) and hangers shall be not less than the equivalent of 1-inch by 4-inch (25 mm by 102 mm) wood members providing proper nailing.

2319.2 Spacing. Joists and rafters, where a plaster ceiling is directly supported, shall comply with Section 2507.2.3.

2319.3 Bearing.

2319.3.1 Joists and rafters shall have not less than three inches of bearing, on wood, metal, grout filled masonry or concrete except as provided in Sections 2319.3.2, 2319.3.3 and 2319.3.4.

2319.3.2 Masonry and concrete.

2319.3.2.1 Joists and rafters may bear on and be anchored by steel strap anchor embedded into a grout filled cell of the masonry or reinforced concrete, as described in Sections 2321.5.1, to a wood plate provided such wood plate is of an approved durable species or pressure treated with an approved preservative and such plate shall be not less than 2 inch by 4 inch (51 mm by 102 mm) and attached as per Section 2318.1.4.1. The net uplift on the plate shall be limited to 300 pounds per foot (4378 N/m).

2319.3.2.2 Joists and rafters may bear on a Product Approved channel-shaped metal saddle and fastened to the masonry by a steel strap anchor embedded into a grout filled cell of the masonry or concrete.

2319.3.2.3 Joists and rafters may bear on masonry, provided that each joist or rafter in contact with masonry is of an approved durable species or pressure treated with an approved preservative and anchored as in Section 2319.3.2.2 above.

2319.3.3 Floor joists may butt into a header beam if effectively toenailed and if an approved metal hanger providing not less than 3 inches (76 mm) of bearing transmits the vertical load to the top of the header, provided, however, that approved devices or other approved means of support may be used in lieu of such bearing. All hangers and devices shall have Product Approval.

2319.3.4 Ceiling joists may butt into a header beam, as set forth for floor joists, or approved devices or other approved

means of support may be used in lieu of such bearing. All devices shall have Product Approval.

2319.3.5 In lieu of the above, bearing and anchorage may be designed by rational analysis by a registered professional engineer or registered architect proficient in structural design.

2319.4 Splicing. Horizontal members shall not be spliced between supports except that properly designed splices or approved end-jointed lumber may be used.

2319.5 Notching and boring.

2319.5.1 Unless local unit stresses are calculated on the basis of reduced size, wood members in bending shall not be cut, notched or bored except as provided in Sections 2319.5.1.1 and 2319.5.1.2.

2319.5.1.1 Notches may be cut in the top or bottom not deeper than one-sixth of the depth not longer than one-third of the depth of the member and shall not be located in the middle one-third of the span. Where members are notched at the ends, over bearing points, the notch depth shall not exceed one-fourth the member depth.

2319.5.1.2 Holes may be bored in the middle one-third of the depth and length and not larger than one-sixth of the depth. Space between any two holes in the same joist shall be not less than the depth of the joist.

2319.5.2 Where necessary to run service pipes in the space between the ceiling and floor larger than can be accommodated by the above provision, such ceilings shall be furred or provision made for headers or beams and/or for changing direction of the joists where the design permits.

2319.6 Openings.

2319.6.1 Joists shall be doubled adjacent to openings where more than one joist is cut out or shall be so increased in size or number as may be needed to meet the stress requirements.

2319.6.2 Headers shall be of the same size as the joists and where supporting more than one joist shall be double members.

2319.6.3 Headers shall be supported by approved metal hangers or ledgers or other approved members.

2319.7 Wood entering masonry or reinforced concrete.

2319.7.1 Wood joists, beams or girders which frame into masonry or reinforced concrete shall have a minimum of $^1/_2$-inch (12.7 mm) air space at the top, end and sides or shall be preservative pressure treated or of an approved durable species.

2319.7.2 Where masonry extends above such wood members, joists shall be fire-cut so the top edge does not enter the masonry more than 1 inch (25 mm) or shall be provided with wall plate boxes of self-releasing type or approved hangers.

2319.7.3 Where joists enter a masonry wall required to be fire resistive, such joists shall be separated from the opposite side of the wall by at least 4 inches (102 mm) of solid masonry.

2319.8 Floor joists.

2319.8.1 Floor joists under all walls or partitions parallel to the joists shall be doubled.

2319.8.2 Doubled joists may be separated not more than 6 inches (152 mm).

2319.8.3 Floor joists supporting concrete or grout for tile floors shall have a maximum spacing of 12 inches (305 mm).

2319.9 Ceiling joists.

2319.9.1 In buildings with pitched roofs the ceiling joists, where practicable, shall be nailed to the rafters and shall be designed to carry all imposed loads including but not limited to lateral thrust.

2319.9.2 Ceiling joists spanning more than 10 feet (3 m) shall be laterally supported at midspan.

2319.9.3 Ceiling joists shall not be used to support rafter loads unless the joists and connections are properly designed for the total load being imposed.

2319.10 Roof framing. The permit documents shall include roof framing plans showing spacing and spans of all roof members indicating any fabricated elements to be designed and furnished by others and shall include the details for support and bearing of the roof structural system, for the permanent cross/lateral/diagonal bracing and anchorage required to resist dead, live and wind loads as set forth in Chapter 16 (High-Velocity Hurricane Zones). The framing plans shall also indicate the uplift forces applied on the roof, sheathing type, thickness and nailing requirements for the sheathing. The roof framing plans shall be prepared by and bear the sign and seal of, a registered professional engineer or registered architect of record proficient in structural design.

2319.11 Roof joists. Roof joists may cantilever over exterior walls as limited by the allowable stress, but the length of such cantilever shall not exceed one-half the length of the portion of the joist inside the building; and where the cantilever of tail joists exceeds 3 feet (914 mm), the roof joist acting as a header shall be doubled.

2319.12 Roof rafters.

2319.12.1 Hip rafters, valley rafters and ridge boards shall be provided and shall be not less in size than the largest rafter framing thereto nor less than required to support the loads.

2319.12.2 Collar ties.

2319.12.2.1 Collar ties and their connections shall be provided to resist the thrust of rafters and shall be designed by a registered engineer or registered architect proficient in structural design.

2319.12.2.2 Collar ties shall not be required if the ridge is designed as a supporting beam. Such design shall be done by a registered professional engineer or registered architect proficient in structural design.

2319.12.2.3 Ceiling joists may serve as collar ties when properly designed by a registered professional engineer or registered architect proficient in structural design.

2319.12.3 The actual roof and ceiling dead loads may be used to resist uplift loads, but the maximum combined dead

load used to resist uplift loads shall not exceed 10 pounds per square foot (479 Pa).

2319.13 Heavy timber construction. Heavy timber construction of floors or roofs shall comply with the standards in Section 2314.4. All heavy timber construction shall be designed by a registered professional engineer or registered architect proficient in structural design to withstand the loads required in Chapter 16 (High-Velocity Hurricane Zones).

2319.14 Vertically laminated beams. Vertically laminated built-up beams shall be designed and made up of members continuous from bearing to bearing.

2319.15 Glued-laminated members. Glued-laminated members shall be designed to comply with applicable AITC standards adopted by this code.

2319.16 Stair stringers.

2319.16.1 Stair stringers shall, where practicable, be framed to provide 4 inches (102 mm) of bearing at the ends.

2319.16.2 Where it is not practicable to provide such bearing, the stringers shall be hung in steel hangers of approved type.

2319.16.3 Stair stringers shall not be notched or cut in the effective area.

2319.16.4 Two stringers shall be provided for each flight of stairs no more than 36 inches (914 mm) in width, and an additional stringer shall be provided for each 18 inches (457 mm) of additional stair width except for public stairs where the number of stringers shall be determined by rational analysis by a registered professional engineer or registered architect proficient in structural design.

2319.17 Wood trusses.

2319.17.1 Trussed rafters. Trussed rafters shall be designed by methods admitting of rational analysis by a registered professional engineer or registered architect proficient in structural design based on the standards set forth in Section 2314.4.

2319.17.1.1 Where steel is used for connecting wood members, such connectors shall be not less than 20 U.S. gage and shall be protected with a zinc coating conforming to ASTM A 361 set forth in Chapter 35 of this code. Connectors shall have Product Approval or shall be designed by methods admitting of rational analysis by a registered professional engineer or registered architect proficient in structural design.

2319.17.1.2 Where a ceiling is to be attached directly to the underside of trusses, the trusses shall be laterally braced with continuous 1-inch by 4-inch (25 mm by 102 mm) members nailed with 8d common nails to the upper side of the bottom chord at panel points but not to exceed 10 feet (3 m) apart. This lateral bracing shall be restrained at each end and at 20-foot (6 m) intervals. Drywall may be considered a rigid ceiling in enclosed areas where it is protected from the elements. The drywall ceiling is not to be considered a ceiling diaphragm.

2319.17.1.3 Where a ceiling is to be attached to wood stripping which is nailed to the underside of the bottom chord of trusses with two-8d common nails at each intersection, stripping shall be not less than 1 inch by 3 inches (25 mm by 76 mm) spaced not more than 24 inches (610 mm) apart. Wood stripping may be replaced by furring channels. Furring channels shall be a minimum of $^{7}/_{8}$ inch (22 mm) hat-shaped channels weighing 287 pounds per 1000 lineal feet (41.4 kg per 100 m) with minimum based steel of 0.0179 inch (0.445 mm) and complying with ASTM C 645 attached to trusses with minimum two #6 1-$^{1}/_{4}$ inch (32 mm) screws per intersection. Said stripping or metal furring channels may serve also as the lateral bracing of the truss bottom chord so as to minimize the effects of buckling of the bottom chord when subjected to compressive stresses under reverse load conditions. In addition, the rigid ceiling that is created by this 1-inch by 3-inch (25 mm by 76 mm) stripping or metal furring channels must also be restrained from lateral movements, in accordance with the details provided by the architect or professional engineer of record.

Exception: Where fire-rated design assembly does not allow for this specific installation, see Section 2319.17.1.2

2319.17.1.4 Where a ceiling is attached to wood members suspended beneath trusses, the provisions of Section 2319.1 shall apply.

2319.17.2 Prefabricated wood trusses. Prefabricated wood trusses shall comply with this section.

2319.17.2.1 Design.

2319.17.2.1.1 Prefabricated wood trusses shall be designed by a registered professional engineer (delegated engineer) and fabricated in accordance with the *National Design Standard for Metal Plate Connected Wood Truss Construction of the Truss Plate Institute* (TPI). The truss system designer (delegated engineer) shall prepare the truss system shop drawings. Such shop drawings shall be submitted to the building official for review and approval. The shop drawings shall meet the following requirements:

1. All shop drawings shall be in conformity with the architect or engineer of record framing plans unless prior written approval is obtained from the architect or engineer of record. If reframing is approved, the architect or engineer of record shall resubmit revised framing plans to the building official after receiving updated plans from the delegated engineer showing all adjustments necessary to safely transmit all applied loads to the foundation.
2. Permanent bracing of individual truss members may be required on certain members of the trusses to prevent the members from buckling in the plane normal to the trusses (buckling in the narrow direction). This bracing shall be designed for both upward and downward loads and shall be shown on the individual truss drawings (truss engineering usually shown on 8$^{1}/_{2}$-inch by 11-inch (216 mm by 279 mm)

sheets ("A" size drawings). The design of this bracing shall be the responsibility of the delegated engineer. The contractor shall be responsible for seeing that this bracing is properly installed. This bracing may be in the form of (but not limited) to "T" bracing of an individual member, or lateral bracing of a series of members common to a number of trusses. Where lateral bracing is used, this bracing shall be restrained against lateral movement, in accordance with details provided by the delegated engineer or by the architect or professional engineer of record. All details and sections required to show the size and connections of all secondary members will be supplied on the delegated engineering plans and shall show all framing, connections and bracing on one or more primary plans of minimum size 24 inches by 36 inches (610 mm by 914 mm).

3. A size $8^1/_2$-inches by 11-inches (216 mm by 279 mm) cut sheets showing individual member design shall also be furnished to the architect or engineer of record so that all gravity and uplift loads shown on these cut sheets can be transferred to the primary plans.
4. The size and location of all plates at each joint shall be shown on the truss design drawings.
5. The connection between trusses shall be detailed in the shop drawings. Hip sets shall be detailed in a manner to indicate all connections according to engineering drawings for the attachment of skewed members.
6. Truss design drawings shall indicate the support and minimum bearing of the roof structural system, the permanent cross/lateral bracing, bracing to transfer member buckling forces to the structure and all bracing and anchorage required to resist uplift and lateral forces.
7. Flat and floor trusses must be clearly marked so that they will be installed right side up. These marks must remain after the flooring, sheathing and insulation have been installed.

The intent of the above requirements is to provide all information on framing, connections and bracing on one composite set of plans approved by the architect or engineer of record to aid in the review, approval and field inspections for the portion of the property.

2319.17.2.1.2 Trusses shall be designed for wind loads per Chapter 16 (High-Velocity Hurricane Zones), uniformly distributed live, dead and concentrated loads, and such loads shall be indicated on the roof framing plans and the truss design drawings. Where a girder or truss is subjected to concentrated loads or any unusual loading condition, such conditions must be clearly indicated on the roof framing plans and on the truss design drawings. Where truss members have been cut, shifted or altered in any manner to meet construction needs or for any other reason, additional drawings and additional calculations must be prepared, signed and sealed by the truss designer (a Florida-delegated engineer). Such additional drawings and calculations must be approved by the engineer or architect of record and must be submitted to the building official for review and approval.

2319.17.2.1.3 Roof trusses shall be designed for a minimum live load of 30 psf (1436 Pa), a minimum dead load of 15 psf (718 Pa) on the top chord, and a minimum dead load of 10 psf (479 Pa) on the bottom chord; and wind loads per Chapter 16 of this code. Where the roof design is such that water is not directed to the interior of the roof and there are no parapets or other roof edge drainage obstructions, roof trusses with slopes of $1^1/_2$:12 or greater may be designed for a live load of 20 psf (958 Pa) and a minimum total load of 45 psf (2155 Pa). Adjustment of the allowable design stress for load duration shall be in accordance with *National Design Specification for Wood Construction* except that load duration factor for wind loads shall not exceed 1.33.

2319.17.2.1.4 The allowable deflection under live load for trusses shall not exceed span/360 for plastered ceilings, span/240 for unplastered finished ceilings, or span/180 for trusses without a ceiling.

2319.17.2.1.5 Flat roof trusses shall be designed for not less than the loads set forth in Section 2319.17.2.1.3 above, except that the dead load on the top chord may be taken as 10 psf (479 Pa) in lieu of 15 psf (718 Pa), and the total load reduced to 50 psf (2394 Pa). Adjustment of the allowable design stress for load duration shall be in accordance with *National Design Specification for Wood Construction* except that load duration factor for wind loads shall not exceed 1.33.

2319.17.2.1.6 Where gable end trusses are permitted in this code, they shall be designed for a minimum live load of 30 psf (1436 Pa) and a minimum dead load of 15 psf (718 Pa) on the top chord. The minimum load of 10 psf (479 Pa) on the bottom chord may be omitted where continuous support is provided. In addition, the gable end trusses shall be designed to sustain wind load as specified in Chapter 16 (High-Velocity Hurricane Zones) but not less than 30 psf (1436 Pa) perpendicular to the plane of the truss. Such trusses shall use a rationally designed system to resist lateral wind loads and be anchored to the substructure at intervals no greater than 4 feet (1219 mm) on center to resist the uplift forces and shall be designed to transfer the loads to the substructure. The design of the system used to resist the lateral loads imposed on the truss shall be prepared by the engineer or architect of record.

2319.17.2.1.7 When girders exceed two members and when girder reactions exceed the capacity of standard connectors or hangers, these reactions shall be shown on the drawings and the connection must be designed, signed and sealed by a registered profes-

sional engineer or registered architect proficient in structural design and such design shall be included as part of the shop drawings.

2319.17.2.1.8 All trusses shall be properly braced to act as a system. Such bracing shall be included as part of the design document.

2319.17.2.2 Materials and specifications.

2319.17.2.2.1 Trusses shall be fabricated applying the design values listed in the standard *Design Values for Wood Construction of the American Forest and Paper Association.*

2319.17.2.2.2 Top and bottom chords shall be of No. 2 Grade or better. Web members shall be of No. 3 Grade or better. A chord member is defined as the entire top or bottom truss member which may consist of shorter spliced pieces.

2319.17.2.2.3 For trusses spanning 20 feet (6 m) or less, the minimum percentage of grade-marked members among top and bottom chords shall be 50 percent.

2319.17.2.2.4 For trusses spanning more than 20 feet (6 m) the minimum percentage of grade-marked members among top and bottom chords shall be 75 percent, and there shall be a minimum of one marked web on each truss.

2319.17.2.2.5 All lumber shall be 2 inches by 4 inches (51 mm by 102 mm) nominal or larger, and no 2 inch (51 mm) nominal member shall be less in size than 1 $^{1}/_{2}$ inch (38 mm).

2319.17.2.2.6 The moisture content of all lumber used in wood truss fabrication shall not exceed 19 percent.

2319.17.2.2.7 Connector plates shall be not less than 20 gauge galvanized steel meeting ASTM A 653/A 653M or A 924/A 924M, and shall be identified by the manufacturer's stamp. The size and location of all plates shall be shown on the truss design drawings. Connectors shall have product approval.

2319.17.2.2.8 All connector plates over 3 inches (76 mm) and 25 percent of 3 inches (76 mm) or less, as per TPI standards, shall bear the name, logo or other markings, which clearly identify the manufacturer. Semiannually, plate manufacturers shall certify compliance with the provisions of Section 6 of the Truss Plate Institute, TPI, *National Design Standard for Metal Plate Connected Wood Truss Construction*, with respect to the grade of steel, thickness or gauge of material, and galvanizing to ASTM G 60 as a minimum. This certification requirement shall be satisfied by submitting by an approved independent laboratory to the certification agency.

2319.17.2.3 Fabrication.

2319.17.2.3.1 Manufacturers of prefabricated wood truss assemblies shall obtain a valid certificate of competency from the authority having jurisdiction.

2319.17.2.3.2 Each truss shall bear the fabricators stamp on a web member and 75 percent shall be placed so as to be clearly visible after erection and before placement of ceiling.

2319.17.2.3.3 Multiple member girder trusses shall be predrilled at the truss plant for connection bolts only. Hanger bolt holes shall be drilled on-site on location indicated on approved drawings.

2319.17.2.3.4 Each manufacturer or fabricator shall retain the services of applicable organizations among those listed below for monthly inspections of the lumber grade used in fabrication. Following each inspection, a report shall be submitted by the inspection agency to the authority having jurisdiction. All inspection agencies providing any type of inspection services shall be approved by the authority having jurisdiction.

For Pine: Southern Pine Inspection Bureau or Timber Products grading agencies with appropriate jurisdiction.

For Douglas Fir, Hem-Fir or Fir-Larch: Western Wood Products Association or West Coast Lumber Inspection Bureau. Timber Products Inspection Inc. or other grading agencies with appropriate jurisdiction.

2319.17.2.3.5 In addition, the fabricator shall employ an approved testing laboratory to conduct inspections of fabrication compliance. Such inspections shall be made unannounced and at random at least once a month. Following each inspection, a report on approved forms shall be submitted by the laboratory to the authority having jurisdiction and such reports shall bear the date, signature and seal of the supervising Florida-registered architect or professional engineer.

2319.17.2.3.6 When there is evidence of noncompliance with the provisions for fabrication set forth in this paragraph or with the approved plans, the authority having jurisdiction may require the inspection laboratory to make additional job-site or plant inspections.

2319.17.2.3.7 The authority having jurisdiction may require load testing on noncomplying wood trusses. The test results shall be reported to the authority having jurisdiction.

2319.17.2.3.8 Failure of units tested or receipt of inspection reports indicating fabrication not in accordance with approved truss design drawings, or failure to submit required inspection and/or test reports, shall be cause for suspension or revocation of the certificate of competency of the manufacturer or fabricator.

2319.17.2.4 Truss erection.

2319.17.2.4.1 All trusses shall be erected in accordance with TPI/WTCA BCSI 1 in addition to any requirements indicated on the approved permit document.

2319.17.2.4.2 For trusses having an overall length of the bottom chord in excess of 35 feet (10.7 m) or 6 feet (1829 mm) overall height erection shall be supervised by either a registered professional engineer or registered architect retained by the contractor. A retainer letter from the registered professional engineer or registered architect shall be submitted along with the shop drawings as part of the permit document.

2319.17.2.4.3 Temporary bracing shall be required during the erection of roof trusses to keep the trusses in a true plumb position and to prevent toppling of the trusses during erection, until the roof sheathing is applied. The provisions for temporary bracing shown in TPI/WTCA BCSI 1 shall be used for this bracing or a professional engineer or architect shall design the temporary bracing system. The ultimate responsibility to see this bracing is installed properly during the erection process lies with the permit holder. This bracing is extremely important for the protection of life and property during the erection process. Temporary truss bracing shall always be required.

2319.17.2.4.4 At gable ends, this diaphragm shall be designed to transmit lateral loads imposed on the gable to roof diaphragms and/or ceiling diaphragms where available. Where the wall supporting the gable is not designed to withstand lateral loads independent of the gable (by using shear walls or other methods), anchorage of the gable to the wall shall be designed to transmit the loads from the wall to the bracing and the bracing designed to transmit the lateral loads from the gable and wall to the roof diaphragms and/or ceiling diaphragms where available. Ceiling diaphragms that provide lateral support at gable walls shall be designed by the architect or professional engineer of record, and shall have continuous bottom chord bracing, end restraints, intermediate restraints and conditions so as to sufficiently transfer the lateral loads at the top of the gable end walls to the intersecting shear walls. In no case shall the rigid ceiling as defined in Section 2319.17.1.2 be used as an integral part of the system needed for lateral bracing of the gable end walls.

2319.17.2.4.5 Where masonry or reinforced concrete extends above wood trusses; trusses shall be designed so as not to compromise the structural integrity of the masonry or concrete wall it abuts in the event of collapse caused by fire.

SECTION 2320
HIGH-VELOCITY HURRICANE ZONES — FIRESTOPS

2320.1 Firestopping shall be provided to cut off all concealed draft spaces both vertical and horizontal.

2320.1.1 Firestops shall form effective fire barriers between stories and between a story and roof space.

2320.1.2 Firestopping shall be tightly and securely fitted into place and where of wood, shall be not less than a nominal 2 inches (51 mm) in thickness.

2320.1.3 Spaces between chimneys and wood framing shall be solidly filled with mortar or loose incombustible materials supported on incombustible supports.

2320.1.4 Firestopping shall consist of 2-inch (51mm) nominal lumber, or two thicknesses of 1 inch (25 mm) nominal lumber with broken lap joints, or 1 thickness of $^{23}/_{32}$ inch (18 mm) plywood, with joints backed by $^{23}/_{32}$ inch (18 mm) plywood, or other approved materials.

2320.1.5 Draftstopping materials shall be not less than $^{3}/_{8}$ inch (9.5 mm) plywood or other approved materials adequately supported.

2320.1.6 Required firestops and draftstops shall be continuous, and such continuity shall be maintained throughout. Penetrations of firestops or draft stops shall be sealed or proected in an approved manner.

2320.1.7 Ventilation of concealed roof spaces shall be maintained in accordance with Section 2326.3.2.

2320.2 Firestopping shall be installed in wood frame construction in the locations specified in Sections 2320.2.1 through 2320.2.6.

2320.2.1 In concealed spaces of stud walls and partitions including furred spaces at ceiling and floor levels to limit the maximum dimension of any concealed space to 8 feet (2438 mm).

2320.2.2 At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and similar features.

2320.2.3 In concealed spaces between stair stringers at least once in the middle of each run, at the top and bottom, and between studs along and in line with adjacent run of stairs of the run.

2320.2.4 At openings around vents, pipes, ducts, chimneys and fireplaces at ceiling and floor levels with approved noncombustible materials, except in the case of approved metal chimney installation.

2320.2.5 In concealed spaces created by an assembly of floor joists, firestopping shall be provided for the full depth of the joists at the ends and over the support.

2320.2.6 Around the top, bottom and sides of door pockets.

2320.3 Draftstopping. Draftstopping shall be provided in wood frame construction in the locations specified in Sections 2320.3.1 and 2320.3.2.

2320.3.1 Floor-ceiling assemblies.

2320.3.1.1 Group B and M occupancies. In the floor-ceiling assemblies above and in line with the tenant separation, when tenant separation walls do not extend to the floor sheathing above.

2320.3.1.2 Groups R1, R2 and R4 occupancies. In floor-ceiling assemblies separating usable spaces into

two or more approximate areas with no area greater than 500 square feet (46.5 m^2). Draftstopping shall be provided parallel to the main framing members in the floor-ceiling assemblies of multiple-family dwellings, motels and hotels above and in line with the tenant separation, when tenant separation walls do not extend to the floor sheathing above.

2320.3.1.3 Other occupancies. All other buildings, in floor-ceiling assemblies so that horizontal areas do not exceed 1,000 square feet (93 m^2).

2320.3.2 Attics.

2320.3.2.1 Group R1. In the floor-ceiling assemblies above and in line with the tenant separation, when tenant separation walls do not extend to the floor sheathing above.

2320.3.2.2 Group R3. None required.

Exceptions:

1. Where corridor walls provide a tenant separation, draftstopping shall be required above only one of the corridor walls.
2. Where flat roofs with solid joist construction are used, draftstopping over tenant separation walls is not required.
3. Where approved sprinklers are provided, draftstopping shall be required for attic spaces over 9000 square feet (836 m^2) in area.

2320.3.2.3 Other buildings. In attic spaces so that horizontal areas do not exceed 3,000 square feet (279 m^2).

Exceptions:

1. Where flat roofs with solid joist construction are used, draftstopping over tenant separation walls is not required.
2. Where approved sprinklers are provided, the area may be tripled.

SECTION 2321
HIGH-VELOCITY HURRICANE ZONES — ANCHORAGE

2321.1 Anchorage shall be continuous from the foundation to the roof and shall satisfy the uplift requirements of Section 1620.

2321.2 Joists.

2321.2.1 Fire-cuts into a masonry wall shall be anchored to the concrete beam on which they bear.

2321.2.2 Such anchors shall be spaced not more than 4 feet (1219 mm) apart and shall be placed at opposite ends across the building on the same run of joists.

2321.3 Joists shall be nailed to bearing plates, where such plates occur, to each other where continuous at a lap and to the studs where such studs are contiguous; and ceiling joists shall be nailed to roof rafters where contiguous.

2321.4 Every roof rafter and/or roof joist shall be anchored to the beam or studs on which they bear, and roof rafters opposing at a ridge shall be anchored across the ridge as set forth in Section 2321.6.

2321.5 Anchorage to concrete.

2321.5.1 Anchorage designed to resist uplift forces, securing wood to concrete shall be steel straps embedded in the concrete minimum of 4 inches (102 mm) with hooking devices to top steel of tie beam designed to withstand the uplift forces set forth by the design professional. Straps shall be approved under the criteria set by the certification agency. All anchors and related fasteners shall be galvanized.

2321.5.2 As an alternate to using the straps described in this section, the building official may approve other anchorage submitted by a Florida-registered professional engineer or a Florida-registered architect, proficient in structural design, provided that the information set forth in Section 2321.7(1), (2) and (3) submitted in connection with such anchors and such anchors and the proposed assembly otherwise comply with the requirements of this code.

2321.6 Anchorage to wood.

2321.6.1 Anchorage designed to resist uplift forces, securing wood to wood shall be steel straps nailed to each member and shall be designed to resist uplift forces set forth by the design professional. Straps shall be approved under the criteria set by the certification agency. All anchors and relative nails shall be galvanized.

2321.6.2 As an alternate to using straps described in this section, the building official may approve other anchorage submitted by a Florida-registered architect or a Florida registered professional engineer, proficient in structural design, provided that the information set forth in Section 2321.7(1), (2) and (3) submitted in connection with such anchors and such anchors and the proposed assembly otherwise comply with the requirements of this code.

2321.7 Testing of anchoring. Anchoring required by Sections 2321.5 and 2321.6 shall be tested under the following criteria:

1. Concrete to wood straps: Minimum design uplift load 700 pounds (3114 N), with four 16d nails with upper end bent over truss chord and nailed. Nails shall be clinched. Anchors shall have devices to hook into upper tie beam steel and embedded a minimum of 4 inch (102 mm) in concrete.
2. Wood to wood straps: Minimum design uplift 700 pounds (3114 N) with 4 16d nails in each member.
3. Other anchors: Minimum design uplift 700 pounds (3114 N).
4. The criteria stated in Section 2321.7(1), (2) and (3) above are minimum requirements for product approval for the certification agency. Anchor design and uplift forces shall be submitted to the certification agency for approval together with sufficient documentation and test data to verify performance. A product approval shall be maintained at the job site for the inspector to compare with the uplift force requirements of the design professional as shown on approved plans.

SECTION 2322
HIGH-VELOCITY HURRICANE ZONES — SHEATHING

2322.1 Floor sheathing.

2322.1.1 Floor sheathing, where a part of a required fire-resistive assembly, shall comply with a nationally recognized testing agency (Underwriter's Laboratory, Factory Mutual, etc.).

2322.1.2 The finish floor shall be tongue-and-grooved not less than nominal 1-inch (25 mm) lumber laid perpendicular to the joists with end joints on the joists, or a subfloor shall be provided as set forth in Sections 2322.1.3, 2322.1.4, 2322.1.5, and 2322.1.6.

2322.1.3 Square-edged or spaced subflooring may be used only under a finish floor having a strength equal to or greater than $^1/_2$ inch (12.7 mm) tongue-and-groove wood strip flooring; and under finish floors of less strength, a tongue-and-groove or plywood subfloor shall be required.

2322.1.4 Lumber subflooring shall be not less than $^5/_8$-inch (17 mm) thick when joists are spaced no more than 16 inches (406 mm) on center nor less than $^3/_4$ inch (19 mm) thick when joists are spaced no more than 24 inches (610 mm) on center. End joints shall be on joists, joints shall be staggered and parallel to the joists, and ends at walls and similar places shall be supported by a ribbon or by blocking.

2322.1.5 Plywood subfloors of C-D grade or underlayment grade bonded to wood joist using adhesives meeting the requirements of ASTM D 3498 shall be applied as indicated in Section 2322.1.6.

2322.1.6 Plywood subflooring shall be continuous over two or more spans with face grain perpendicular to the supports. The allowable spans shall not exceed those set forth in Table 2322.1.6.

TABLE 2322.1.6
PLYWOOD SUBFLOOR[1]

PANEL SPAN RATING[2]	MAXIMUM PLYWOOD SPAN (IN.)[3]
32/16	16[4]
40/20	20[4]
48/24	24

For SI: 1 inch = 25.4 mm.

NOTES:

1. These values apply for Sheathing C-D and C-C grades only. Spans shall be limited to values shown, and reduced for the possible effects of concentrated loads.
2. Span Ratings shall appear on all panels.
3. Plywood edges shall have approved tongue-and-groove joints or shall be supported with blocking unless $^1/_4$ inch minimum thickness underlay is installed or $^1/_2$ inch of approved cellular or lightweight concrete is installed or unless finish floor is 1inch nominal wood strip. Allowable uniform load based on deflection of 1/360 of span is 100 pounds per square foot.
4. May be 24 inches if nominal 1 inch wood strip finish floor is laid at right angles to joists.

2322.1.6.1 Plywood panels shall be nailed to supports with 6d common nails when up to $^1/_2$-inch thick (13 mm) , 8d common nails when $^{19}/_{32}$ to $^3/_4$ inch (15 to 19 mm) thick and 10d common nails or 8d ring shank when 1 $^1/_8$ inches (29 mm) thick.

2322.1.6.2 Nail spacing shall be 6 inches (152 mm) o.c. at panel edges and 10 inches (254 mm) o.c. at intermediate supports.

2322.1.7 Any other subfloor panel shall have certification agency approval and shall be installed in accordance with the procedures set forth in the approval.

2322.1.8 Flooring shall be nailed with 8d common nails up to $^3/_4$ inch (19 mm) thick, and 10d common nails or 8d ring shank nails when greater than $^3/_4$ inch (19 mm) thick up to 1 $^1/_8$ inches (29 mm) thick.

2322.1.8.1 Nails shall be hand driven 8d common nails [0.131 inch (3.3 mm) diameter by 2 $^1/_2$ inches (63.5 mm) long with 0.281 inch (7.1 mm) diameter full round head)] or power driven 8d nails of the same dimensions (0.131 inch diameter by 2 $^1/_2$ inches long with 0.281 inch diameter full round head). Nails of a smaller diameter or length may be used only when approved by an architect or professional engineer and only when the spacing is reduced accordingly.

2322.1.8.2 Nails shall be hand driven 10d common nails [0.148 inch (3.8 mm) diameter by 3 inch (76 mm) long with 0.312 inch (7.9 mm) diameter full round head] or power driven 10d nails of the same dimensions [0.148 inch (3.8m) diameter by 3 inch (76 mm) long with 0.312 inch (7.9 mm) diameter full round head]. Nails of a smaller diameter or length may be used only when approved by an architect or professional engineer and only when the spacing is reduced accordingly.

2322.1.9 Nail spacing shall be 6 inches (152 mm) on center at panel edges and 10 inches (254 mm) on center at intermediate supports.

2322.1.10 Flooring shall be nailed with 8d common nails not less than two in each board at each support.

2322.1.11 Floors for heavy timber buildings shall be sheathed as specified for mill floors, Section 2319.13.

2322.1.12 Flooring shall not extend closer than $^1/_2$ inch (13 mm) from masonry walls.

2322.1.13 If resilient flooring is to be applied directly to a plywood subfloor without separate underlayment, the plywood shall have a top ply of C-plugged grade or better, and the ply immediately under the face shall be at least C grade unless the face ply is $^1/_6$ inch (4.2 mm) or more in nominal thickness. Plywood shall be continuous over two or more spans with face grain perpendicular to supports. Maximum thickness and maximum joist spacing shall comply with Table 2322.1.13.

TABLE 2322.1.13
ALLOWABLE SPAN FOR PLYWOOD COMBINATION SUBFLOOR UNDERLAYMENT[1]
(SINGLE FLOOR PANELS)

SPECIES GROUPS	MAXIMUM PLYWOOD SPAN (IN.)[2, 3]			
	16[4]	5/8[4]	24	48
1	1/2"	5/8"	3/4"	
2,3	5/8"	3/4"	7/8"	
4	3/4"	7/8"	1"	
1, 2 and 3				1-1/8"

For SI: 1 inch = 25.4 mm.

NOTES:

1. Applicable underlayment grade, C-C (plugged) and all grades of sanded Exterior type plywood.
2. Spans shall be limited to values shown, and reduced for the possible effects of concentrated loads.
3. Allowable uniform load based on deflection of 1/360 of span is 100 pounds per square foot except that total load for 48" on center is 65 pounds per square foot. Plywood edges shall have approved tongue-and-groove joints or shall be supported with blocking unless 1/4 inch minimum thickness underlay is installed or 1/2 inch of approved cellular or lightweight concrete is placed over the subfloor and the sheathing is rated for Exposure 1.
4. If a wood finish floor is laid perpendicular to the joists or supports, thickness shown for 16 inch and 20 inch spans may be used for 24 inch spans.

2322.1.14 Underlayment hardboard shall meet the property requirements for $^{7}/_{32}$ inch (5.6 mm) and $^{1}/_{4}$ inch (6.4 mm) service hardboard and shall be 0.215 +/-0.005 inch (5.5 +/-0.13 mm) thickness; when supported in subflooring such subflooring shall comply with the requirements of Sections 2322.1.3, 2322.1.4, 2322.1.5, and 2322.1.6.

2322.1.15 Particleboard floor underlayment shall conform to Type 1-B-1 of the standard listed in Section 2314.4. Underlayment shall be not less than $^{1}/_{4}$ inch (6.4 mm) in thickness and shall be installed in accordance with the installation instructions of the National Particleboard Association.

2322.1.16 Diaphragm boundaries. All floor sheathing acting as a diaphragm shall be attached to a minimum 2-inch-thick (51 mm) nominal nailer with its depth equal to or one size greater than the intersecting top chord. The nailer shall be connected to the wall to resist the gravity loads from the floor, wind pressure/suction from the exterior wall and the diaphragm forces. The floor sheathing shall be attached to the nailer to resist the wind pressure/suction from the exterior wall and the diaphragm forces.

2322.2 Roof sheathing.

2322.2.1 Wood roof sheathing shall be boards or shall be plywood.

2322.2.2 Board roof sheathing shall have a net thickness of not less than $^{3}/_{4}$ inch (19 mm) when the span is not more than 28 inches (711 mm) or $^{5}/_{8}$ inch (17 mm) when the span is not more than 24 inches (610 mm), shall have staggered joints and shall be nailed with 8d common nails not less than two in each 6 inch board nor three in each 8-inch (203 mm) board at each support.

2322.2.3 Plywood roof sheathing shall be rated for Exposure 1, have a minimum nominal thickness of $^{19}/_{32}$ inch (15 mm) and shall be continuous over two or more spans with face grain perpendicular to supports. Roof sheathing panels shall be provided with a minimum of 2 inch by 4 inch (51 mm by 102 mm) edgewise blocking at all horizontal panel joints with edge spacing in accordance with manufacturer's specifications, for a distance at least 4 feet (1219 mm) from each gable end. The allowable spans shall not exceed those set forth in Table 2322.2.3.

2322.2.4 Plywood panels shall be nailed to supports with 8d ring shank nails.

2322.2.5 Nail spacing shall be 6 inches (152 mm) on center at panel edges and at intermediate supports. Nail spacing shall be 4 inches (102 mm) on center at gable ends with either 8d ring shank nails or 10d common nails.

2322.2.5.1 Nails shall be hand driven 8d ring shank or power driven 8d ring shank nails of the following minimum dimensions: (a) 0.113 inch (2.9 mm) nominal shank diameter, (b) ring diameter of 0.012 inch (0.3 mm) over shank diameter, (c) 16 to 20 rings per inch, (d) 0.280 inch (7.1 mm) full round head diameter, (e) 2- inch (60.3 mm) nail length. Nails of a smaller diameter or length may be used only when approved by an architect or professional engineer and only when the spacing is reduced accordingly.

2322.2.5.2 Nails at gable ends shall be hand driven 8d ring shank or power driven 8d ring shank nails of the following minimum dimensions: (a) 0.113 inch (2.9 mm) nominal shank diameter, (b) ring diameter of 0.012 inch (0.3 mm) over shank diameter, (c) 16 to 20 rings per inch, (d) 0.280 inch (7.1 mm) full round head diameter, (e) $2\,^{3}/_{8}$ inch (60.3 mm) nail length or as an alternative hand driven 10d common nails [0.148 inch (4 mm) diameter by 3 inches (76 mm) long with 0.312 inch (7.9 mm) diameter full round head] or power driven 10d nails of the same dimensions [0.148 inch (4 mm) diameter by 3 inches (76 mm) long with 0.312-inch-diameter (8 mm) full round head]. Nails of a smaller diameter or length may be used only when approved by an architect or professional engineer and only when the spacing is reduced accordingly. Other products with unique fastening methods may be substituted for these nailing requirements as approved by the building official and verified by testing.

2322.2.5.3 Other products with unique fastening methods may be substituted for these nailing requirements as approved by the building official and verified by testing.

TABLE 2322.2.3
ALLOWABLE SPAN FOR PLYWOOD ROOF SHEATHING[1]

PANEL SPAN RATING[2]	MAXIMUM SPAN IF BLOCK OR OTHER EDGE SUPPORTS (IN.)	MAXIMUM SPAN WITHOUT EDGE SUPPORT (IN.)
32/16	24	24
40/20	40	32
48/24	48	36

For SI: 1 inch = 25.4 mm.

NOTES:

1. Values apply to sheathing grade, C-C and C-D panels.
2. Span Rating appears on all C-C and C-D panels.

2322.2.6 Roof sheathing for heavy timber construction shall comply with Section 2319.13 of this code.

2322.2.7 Diaphragm boundaries. All roof sheathing acting as a diaphragm shall be attached to a minimum 2-inch (51 mm) thick nominal member with its depth equal to or one size greater than the intersecting top chord. This shall be achieved with a continuous structural subfascia, fascia or blocking at 4 inches (102 mm) on center with nails as required for the appropriate thickness of sheathing.

2322.2.8 When existing roofs are reroofed to the point that the existing roofing is removed down to the sheathing, the existing roof sheathing shall be renailed with 8d common nails [0.131 inch (3.3 mm) diameter by 2 $^{1}/_{2}$ inches (63.5 mm) long with 0.281 inch (7.9 mm) diameter full round head]. Nail spacing shall be 6 inches (152 mm) on center at panel edges, 6 inches (152 mm) on center at intermediate supports and where applicable 4 inches (102 mm) on center over gable ends and subfascia. Existing fasteners may be used to achieve such minimum spacing.

2322.3 Storm sheathing. Exterior stud walls shall be sheathed to resist the racking load of wind as set forth in Section 1620 and the concentrated loads that result from hurricane-generated wind-borne debris as set forth in Section 1626 of this code and shall be at a minimum any of the following types:

1. Tightly fitted, diagonally placed boards not less than $^{5}/_{8}$ inch (17 mm) thickness, nailed with three 8d common nails to each support for 1 inch by 6 inch (25 mm by 152 mm) boards and four 8d common nails for 1 inch by 8 inches (25 mm by 203 mm) boards.
2. Wall sheathing shall be plywood, or Product Approved structural panel, rated Exposure 1 with a minimum thickness of $^{19}/_{32}$ inch (15 mm) and shall be applied to studs spaced not more than 16 inches (406 mm) on center. Wall sheathing shall be continuous over three or more supports and shall be nailed to such supports with 8d common nails. Nail spacing shall not exceed 6 inches (152 mm) on center at panel edges and all intermediate supports. Nail spacing shall be 4 inches (102 mm) on center at corner studs, in all cases.
3. When plywood panel, or Product Approved structural panel, sheathing is used, building paper and diagonal wall bracing can be omitted.
4. When siding such as shingles nailed only to plywood or Product Approved structural panel sheathing, the panel shall be applied with face grain across studs.

2322.4 Exterior wall cladding.

2322.4.1 Plywood, if protected with stucco, may serve for both sheathing and exterior cladding provided:

1. The panel thickness shall be not less than $^{19}/_{32}$ inch (15 mm) and Texture 1-11 panels, and the supporting studs shall be spaced not more than 16 inches (406 mm) o.c.
2. All joints shall be backed solidly with 2 inch (51 mm) nominal blocking or studs or the joints shall be lapped horizontally or otherwise watertight.
3. Nailing shall be as set forth in Section 2322.3(2).

2322.4.2 Where storm sheathing is provided in accordance with Section 2322.3, exterior cladding may be one of the following:

1. Wood siding shall be installed according to its Product Approval.
2. Wood shingles or shakes attached to the storm sheathing, and/or to nailing boards or shingle backer securely attached to the storm sheathing. The minimum thickness of wood shingles or shakes between nailing boards shall be $^{3}/_{8}$ inch (9.5 mm).
3. Hardboard of siding quality for exterior use shall be applied in accordance with the Product Approval.

SECTION 2323
HIGH-VELOCITY HURRICANE ZONES—FURRING

2323.1 Where the interior of masonry walls is furred, such furring shall be treated and firestopped as herein required and shall be securely fastened to the masonry with not less than one cut nail in alternate course of block.

SECTION 2324
HIGH-VELOCITY HURRICANE ZONES—CONNECTORS

2324.1 The allowable loads on all types of connectors shall be as set forth in the standards listed in Section 2314.4 and Table 2324.1.

2324.2 Nails, bolts and other metal connectors that are used in locations exposed to the weather shall be galvanized or otherwise corrosion resistant.

2324.3 In general, nails shall penetrate the second member a distance equal to the thickness of the member being nailed thereto. There shall be not less than two nails in any connection.

2324.4 Except for wood-based structural-use panels and other laminated members manufactured under technical control and rigid inspection, gluing shall not be considered an acceptable connector in lieu of the connectors herein specified.

2324.5 Safe loads and design practice for types of connectors not mentioned or fully covered herein shall be determined by the building official before approval.

SECTION 2325
HIGH-VELOCITY HURRICANE ZONES–WOOD SUPPORTING MASONRY

2325.1 Wood shall not support masonry or concrete except as permitted in Sections 2325.2 and 2325.3.

2325.2 Wood foundation piles may be used to support concrete or masonry.

2325.3 Plywood decking and approved wood panels, wood joists and wood studs supporting such wood joists may be used to support reinforced concrete slabs, concrete-base tile and terrazzo floors and lightweight concrete toppings as follows:

1. There shall be an approved moisture vapor barrier between the concrete or other cementitious materials and the wood.
2. Wood members supporting concrete shall be preservative treated in compliance with the standards of AWPA and AWPB set forth in Sections 2314.4 and 2326.
3. Approved wood-based structural-use panel decking shall be rated for Exposure 1.
4. Wood rafters may support concrete roof tile.

SECTION 2326
HIGH-VELOCITY HURRICANE ZONES — PROTECTION OF WOOD

2326.1 Wood piles shall be treated with preservatives as set forth in Section 1823.1.2.

2326.2 Preservative treated or durable species wood.

2326.2.1 All wood used in areas of building or structures where the climatic condition is conducive to deterioration which would affect the structural safety shall be treated in an approved method with an approved preservative or shall be of an approved durable species.

2326.2.2 All wood in contact with or embedded in the ground that supports of permanent structures shall be approved pressure-treated wood suitable for ground contact use.

Exceptions:

1. Naturally durable wood or pressure-treated wood may be used in contact with the ground for support of structures other than buildings and walking surfaces.
2. Untreated wood may be used for supports where entirely below water level and continuously submerged in fresh water.

2326.2.3 Sleepers and sills on concrete slabs in contact with the ground, wood joists and the underside of wood structural floors without joists less than 18 inches (457 mm) above ground; or wood girders less than 12 inches (305 mm) from exposed ground within the crawl space under buildings, shall be treated in an approved method with an approved preservative, or shall be of an approved durable species.

TABLE 2324.1
NAIL CONNECTION FOR WOOD MEMBERS

CONNECTION	COMMON NAILS	NUMBER OR SPACING
Joists to sill or girder, toe nail	16d	2
Bridging to joist, toe nail	8d	2 each end
1-inch x 6-inch subfloor or less to each joist, face nail	8d	2
Over 1-inch x 6-inch subfloor to each joist, face nail	8d	3 + 1 for each size increase
2-inches subfloor to joist or girder, blind and face nail	16d	2
Sole plate to joist or blocking, face nail	16d	16 inches o.c.
Top or sole plate to stud, end nailed	16d	2
Stud to sole plate, toe nail	3d	3 or 2 16d
Doubled studs, face nail	16d	24 inches o.c.
Doubled top plates, face nail	16d	16 inches o.c.
Top plates, laps and intersections, face nail	16d	2
Continuous header, two pieces	16	16 inches o.c.along each edge
Ceiling joists to plate, toe nail	16d	2
Continuous header to stud, toe nail	16d	3
Ceiling joists, laps over partitions, face nail	16d	3
Ceiling joists to parallel rafters, face nail	16d	3
Rafter plate, toe nail	16d	3
1-inch x 6-inch sheathing or less, to each bearing, face nail	8d	2
Over 1-inch x 6-inch sheathing, to each bearing, face nail	8d	3 + 1 for each size increase
Built-up corner studs, face nail	16d	30 inches o.c.
Built-up girders and beams	20d	32 inches o.c. At top and bottom and staggered, 2 at ends and at each splice
2-inch planks	16d	2 each bearing

For SI: 1 inch = 25.4 mm.
NOTE: In spacing specifications, o.c. means "on-center."

2326.2.4 All wood not separated from and/or in direct contact with concrete masonry, including sills, sleepers, plates, posts, columns, beams, girders and furring; shall be treated in an approved method with and approved preservative, or shall be of an approved durable species.

2326.2.5 The expression "pressure treated wood" refers to wood meeting the retention, penetration and other requirements applicable to the species, product, treatment and conditions of use in the approved standards of the American Wood Preservers Association (AWPA). Quality Control Program for Softwood Lumber, Timber and Plywood Pressure Treated with Water-borne Preservatives for Ground Contact Use in Residential and Light Commercial Foundations for the American Wood Preservers Bureau.

2326.2.6 The expression "durable wood" refers to the heartwood of the following species with the exception that an occasional piece with corner sapwood may be included if 90 percent or more of the width of each side on which it occurs is heartwood:

Decay resistant: Redwood, Cedars, Black Locust.

Termite resistant: Redwood, Bald and Eastern Red Cedar.

2326.2.7 Where durable species of wood are used as structural members in buildings and structures, the stress grade shall be not less than that required in Section 2317.

2326.2.8 When wood pressure treated with a waterborne preservative is used in enclosed locations where drying in service cannot readily occur, such wood shall have a moisture content of 19 percent or less before being covered with insulation, interior wall finish, floor covering or other material.

2326.2.9 All wood framing less than 8 inches (203 mm) from exposed earth in exterior walls that rest on concrete or masonry foundations shall be approved naturally durable species or pressure treated wood.

2326.2.10 All posts, poles and columns embedded in concrete which is in contact with ground and supporting permanent structures shall be approved pressure treated wood suitable for ground contact use except naturally durable wood may be used for posts, poles and columns embedded in concrete for structures other than buildings and walking surfaces or in structures where wood is above ground level and not exposed to the weather.

2326.2.11 For conditions not specifically covered, compliance with American Forest & Paper Product Association Wood Construction Data #6 "Design of Wood Frame Structures for Permanence" shall be deemed as compliance with this code.

2326.3 Ventilation.

2326.3.1 Ventilation of crawl spaces. Crawl spaces under buildings without basements shall be ventilated by approved mechanical means or by openings in foundation walls. Ventilation openings shall be covered with a corrosion-resistant wire mesh with openings not greater than $^1/_{16}$ inch (1.6 mm).

2326.3.1.1 Where practicable, ventilating openings shall be arranged on three sides.

2326.3.1.2 The minimum total area of ventilating openings shall be 2 square feet (0.19 m^2) for each 15 linear feet (4.6 m) or a fraction thereof of exterior wall. Such opening need not be placed in the front of the building. Where mechanical ventilation is used, the ventilation rate shall be at least six air changes per hour.

2326.3.2 Ventilation of attic spaces. Attic space between ceiling joists and roof rafters shall be effectively cross-ventilated by approved mechanical means or with vent openings. The ratio of total net free ventilating area to the area of the ceiling shall be not less than $^1/_{150}$.

Exception: The venting ratio may be reduced to $^1/_{300}$ where at least 50 percent of the installed ventilating area is provided by a ventilation system located in the upper portion of the space to be ventilated [within 18 inches (457 mm) of ridge]. The balance of the required ventilation shall be provided by eave or cornice vents.

2326.3.2.1 Where practical, ventilating openings shall be arranged on three sides.

2326.3.2.2 Where mechanical ventilation is used, the ventilation rate shall be at least six air changes per hour.

2326.3.2.3 All openings into the attic space of any habitable building shall be covered with screening, hardware cloth or equivalent to prevent the entry of birds, squirrels, rodents, etc. The openings therein shall not exceed $^1/_8$ inch (3.2 mm).

2326.3.2.4 For existing structures that were built before 1992 without soffit ventilation, and where in the opinion of the building official the soffit ventilation would be impossible or impractical to install, the building official may determine the extent to which the existing structure shall be made to conform to the requirements of this section.

2326.4 Debris.

2326.4.1 Before any new building is erected, all stumps and roots shall be removed from the soil to a depth of at least 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building.

2326.4.2 In buildings or portions thereof having wood first-floor systems, all wood forms which have been used in placing concrete, if within the ground or less than 18 inches (457 mm) above the ground, shall be removed before the building is occupied or used for any purpose.

2326.4.3 Loose or casual wood shall not be stored in direct contact with the ground under any building, and this space must be thoroughly cleaned of all wood and debris.

2326.5 Termite protection. All buildings shall have a pre-construction treatment protection against subterranean termites. The rules and laws as established by the Florida Department of Agriculture and Consumer Services shall be deemed as approved with respect to pre-construction soil treatment for protection against subterranean termites. A certificate of compliance shall be issued to the building department by the licensed pest control company that contains the following statement: "The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accor-

dance with rules and laws established by the Florida Department of Agriculture and Consumer Services."

2326.6 Existing buildings. Whenever the building official has knowledge of the existence of termites in any building or structure, he shall notify the owner in writing and direct that necessary measures be taken for the extermination of the termites within a reasonable length of time, not to exceed 60 days.

2326.6.1 The building official shall inspect existing buildings having wood-stud exterior walls for which application for a permit for exterior wall coverings is made and shall have the authority to order the uncovering of structural elements for inspection and to require necessary repairs as a part of such approval for a permit, or may order demolition.

SECTION 2327
HIGH-VELOCITY HURRICANE ZONES—FIRE RETARDANT WOOD

2327.1 Fire-retardant-treated wood shall be defined as any wood product which, when impregnated with chemicals by a pressure process, or other means during manufacture, shall have when tested in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, a flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10 feet (3 m) beyond the centerline of the burner at any time during the test.

2327.2 The allowable unit stresses for fire-retardant-treated wood including fastener values, shall be developed from an approved method which considers the effects of anticipated temperatures and humidity to which the fire-retardant wood will be subjected, the type of treatment and the redrying process.

2327.3 All fire-retardant-treated wood shall bear an identification mark showing the flame spread classification thereof issued by an approved agency having a reexamination service which maintains a continued supervision and inspection over method of drying. If intended for exterior use, the wood shall be further identified to indicate suitability for exposure to the weather, as defined in Section 2327.5.

2327.4 Where fire-retardant-treated wood is exposed to the weather, it shall be further identified to indicate that there is no increase in the listed flamespread classification as defined in Section 2322.1 when subjected to ASTM D 2898, *Standard Method for Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing.*

2327.5 Where experience has demonstrated a specific need for use of material of low hygroscopicity, fire-retardant-treated wood to be subjected to high humidity conditions shall be identified as Type A to indicate the treated wood has a moisture content of not over 28 percent when tested in accordance with ASTM D 3201 procedures at 92-percent relative humidity.

2327.6 Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for plywood before use. The identification mark shall show the method of drying after treatment. When fire-retardant-treated wood is air dried after treatment (ADAT) it shall be protected so that no leaching of chemicals will occur. Fire-retardant-treated wood kiln dried after treatment (KDAT) shall not be exposed to a dry bulb temperature exceeding 160°F (71°C). If required for curing, exterior fire-retardant-treated wood can be exposed to elevated temperatures when the moisture content of the wood does not exceed 19 percent for lumber or 15 percent for wood structural panels. The curing time shall not exceed 48 hours and the temperature shall not exceed 210°F (99°C).

SECTION 2328
HIGH-VELOCITY HURRICANE ZONE—WOOD FENCES

2328.1 Wood fences, so located on a property that by zoning regulations they cannot be used as a wall of a building, shall be constructed to meet the minimum specifications in Sections 2328.2 and 2328.3.

2328.2 Fences not exceeding 6 feet (1829 mm) in height, shall be constructed to meet the following minimum requirements: from nominal 4-inch by 4-inch by 8-feet-long (102 mm by 102 mm by 2438 mm) posts No. 2 grade or better spaced 4 feet (1219 mm) on center, and embedded 2 feet (610 mm) into a concrete footing 10 inches (254 mm) in diameter and 2 feet (610 mm) deep.

2328.3 Fences not exceeding 5 feet (1524 mm) or 4 feet (1219 mm) in height shall be constructed as provided in Section 2328.2, except that the spacing of posts may be increased to 5 feet (1524 mm) and 6 feet (1829 mm) on center for these heights, respectively.

SECTION 2329
HIGH-VELOCITY HURRICANE ZONES—FIRE-RETARDANT-TREATED SHAKES AND SHINGLES

2329.1 Treated shakes and shingles, when impregnated with chemicals by the full-cell vacuum pressure process, shall be considered fire retardant (classified) roof coverings when tested in accordance with ASTM E 108, *Fire Tests of Roof Coverings,* Including the rain test, ASTM D 2898, *Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.* The fire-resistance tests shall include the intermittent flame test, spread of flame test, burning brand test and flying brand test. In addition, at the conclusion of the rain test, test panels shall be subjected to intermittent flame test, burning brand test and flying brand test.

2329.2 Each bundle of fire-retardant-treated shakes and shingles shall be identified with labels indicating the manufacturer, the classification of the material (Class B) and the quality control agency.

SECTION 2330
HIGH-VELOCITY HURRICANE ZONES—WOOD BLOCKING

2330.1 General.

2330.1.1 Blocking is defined as wood pieces attached to the roof deck or to each other for the purpose of securing roof membrane or accessories.

2330.1.2 Wood blocking attachment for buildings greater than 40 feet (12.2 m) in height must be designed by a registered architect or professional engineer.

2330.1.3 Wood blocking attachment for lightweight insulating concrete, gypsum concrete, cementitious wood fiber and cellular concrete decks shall be designed by a registered architect or professional engineer. The decks themselves shall not be used as a wood blocking attachment substrate.

2330.1.4 Wood blocking shall not be less than nominal 2 inches by 6 inches (51 mm by mm). The maximum unsupported overhang shall be 2 inches (51 mm). When the maximum overhang is employed, a nominal 2-inch by 6-inch (51 mm by mm) blocking shall be installed.

2330.1.5 In recover applications, wood blocking may be reduced to nominal 1 inch (25 mm), providing the attachment is secured in compliance with this code.

2330.1.6 Sound wood blocking may be reused in a recover or reroof application, providing the attachment is secured in compliance with the requirements of this code.

2330.1.7 A fastener shall be placed within 3 inches (761 mm) of the end of each section of wood blocking and a $^1/_4$-inch (6 mm) gap shall be left between each section of wood blocking. No piece of wood shall have less than two fasteners.

2330.1.8 Fasteners other than nails shall be predrilled prior to attachment and countersunk to be flush with the surface of the wood blocking.

2330.1.9 Wood shall be protected according to Section 2326.

2330.1.10 Powder actuated fasteners shall not be used in wood blocking attachment.

2330.2 Attachment to masonry block and concrete.

2330.2.1 Prior to the installation of wood blocking to standard weight masonry block, the two top courses shall be solidly filled with concrete or a tie beam shall be provided as required by this code.

2330.2.2 The fastener's average withdrawal resistance per lineal foot shall be not less than 250 pounds per foot (3649 N/m) after the application of a 4:1 safety factor.

2330.2.3 The pullover value of the proposed fastener though the wood blocking shall be not less than 125 percent of the design load of the proposed fastener. If less, a larger bearing washer shall be added to the fastener assembly to meet this requirement. Wood blocking thickness shall be not less than 1 $^1/_2$ inch (38 mm) if a bearing washer is required.

CHAPTER 24
GLASS AND GLAZING

SECTION 2401
GENERAL

2401.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of glass, light-transmitting ceramic and light-transmitting plastic panels for exterior and interior use in both vertical and sloped applications in buildings and structures.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 2410 through 2415.

2401.2 Glazing replacement. The installation of replacement glass shall be as required for new installations.

SECTION 2402
DEFINITIONS

2402.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material and whose surface, or assembly into which it is incorporated, is divided into segments.

SECTION 2403
GENERAL REQUIREMENTS FOR GLASS

2403.1 Identification. Each pane shall bear the manufacturer's mark designating the type and thickness of the glass or glazing material. With the exception of tempered glazing materials or laminated materials, the identification shall not be omitted unless approved and an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with approved construction documents that comply with the provisions of this chapter. Safety glazing shall be identified in accordance with Section 2406.2.

Each pane of tempered or laminated glass, except tempered spandrel glass, shall be permanently identified by the manufacturer. The identification mark shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed. Tempered or laminated spandrel glass shall be provided with a removable paper marking by the manufacturer.

2403.2 Glass supports. Where one or more sides of any pane of glass are not firmly supported, or are subjected to unusual load conditions, detailed construction documents, detailed shop drawings and analysis or test data assuring safe performance for the specific installation shall be prepared by a registered design professional.

2403.3 Framing. To be considered firmly supported, the framing members for each individual pane of glass shall be designed so the deflection of the edge of the glass perpendicular to the glass pane shall not exceed $^1/_{175}$ of the glass edge length or $^3/_4$ inch (19.1 mm), whichever is less, when subjected to the larger of the positive or negative load where loads are combined as specified in Section 1605.

2403.4 Interior glazed areas. Where interior glazing is installed adjacent to a walking surface, the differential deflection of two adjacent unsupported edges shall not be greater than the thickness of the panels when a force of 50 pounds per linear foot (plf) (730 N/m) is applied horizontally to one panel at any point up to 42 inches (1067 mm) above the walking surface.

2403.5 Louvered windows or jalousies. Float, wired and patterned glass in louvered windows and jalousies shall be no thinner than nominal $^3/_{16}$ inch (4.8 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

Wired glass with wire exposed on longitudinal edges shall not be used in louvered windows or jalousies.

Where other glass types are used, the design shall be submitted to the building official for approval.

SECTION 2404
WIND AND DEAD LOADS ON GLASS

2404.1 Vertical glass. Glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads for components and cladding. The load resistance of glass under uniform load shall be determined in accordance with ASTM E 1300. Design of exterior windows and glass doors in accordance with Section 2404.1 shall utilize the same edition of ASTM E 1300 used for testing in accordance with Section 1714.5.

The design of vertical glazing shall be based on the following equation:

$$F_{gw} \le F_{ga} \qquad \textbf{(Equation 24-1)}$$

where:.

F_{gw} is the wind load on the glass computed in accordance with Section 1609 and F_{ga} is the short duration load resistance of the glass as determined in accordance with ASTM E 1300.

2404.2 Sloped glass. Glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunrooms, sloped roofs and other exterior applications shall be designed to resist the most critical of the following combinations of loads.

$$F_g = W_o - D \qquad \textbf{(Equation 24-2)}$$

$F_g = W_i + D$ **(Equation 24-3)**

$F_g = 0.5\,W_i + D$ **(Equation 24-4)**

where:

D = Glass dead load psf (kN/m^2).

For glass sloped 30 degrees (0.52 rad) or less from horizontal,

= 13 t_g (For SI: 0.0245 t_g).

For glass sloped more than 30 degrees (0.52 rad) from horizontal,

= 13 t_g cos θ (For SI: 0.0245 t_g cos θ).

F_g = Total load, psf (kN/m^2) on glass.

t_g = Total glass thickness, inches (mm) of glass panes and plies.

W_i = Inward wind force, psf (kN/m^2) as calculated in Section 1609.

W_o = Outward wind force, psf (kN/m^2) as calculated in Section 1609.

θ = Angle of slope from horizontal.

Exception: Unit skylights shall be designed in accordance with Section 2405.5. The design of sloped glazing shall be based on the following equation:

$F_g \le F_{ga}$ **(Equation 24-5)**

F_g = Total load on the glass determined from the load combinations above.

F_{ga} = Short duration load resistance of the glass as determined according to ASTM E 1300 for Equations 24-2 and 24-3; or the long duration load resistance of the glass as determined according to ASTM E 1300 for Equation 24-4.

2404.3 Wired, patterned and sandblasted glass.

2404.3.1 Vertical wired glass. Wired glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$F_{gw} < 0.5\,F_{ge}$ **(Equation 24-6)**

where:

F_{gw} = Is the wind load on the glass computed per Section 1609.

F_{ge} = Nonfactored load from ASTM E 1300 using a thickness designation for monolithic glass that is not greater than the thickness of wired glass.

2404.3.2 Sloped wired glass. Wired glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

$F_g < 0.5\,F_{ge}$ **(Equation 24-7)**

For Equation 24-4:

$F_g < 0.3\,F_{ge}$ **(Equation 24-8)**

where:

F_g = Total load on the glass.

F_{ge} = Nonfactored load from ASTM E 1300.

2404.3.3 Vertical patterned glass. Patterned glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$F_{gw} < 1.0\,F_{ge}$ **(Equation 24-9)**

where:

F_{gw} = Wind load on the glass computed per Section 1609.

F_{ge} = Nonfactored load from ASTM E 1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between nonfactored load charts in ASTM E 1300 shall be permitted.

2404.3.4 Sloped patterned glass. Patterned glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

$F_g < 1.0\,F_{ge}$ **(Equation 24-10)**

For Equation 24-4:

$F_g < 0.6F_{ge}$ **(Equation 24-11)**

where

F_g = Total load on the glass.

F_{ge} = Nonfactored load from ASTM E 1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between the nonfactored load charts in ASTM E 1300 shall be permitted.

2404.3.5 Vertical sandblasted glass. Sandblasted glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors, and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$F_g < 0.5\,F_{ge}$ **(Equation 24-12)**

where:

F_g = Total load on the glass.

F_{ge} = Nonfactored load from ASTM E 1300. The value for sandblasted glass is for moderate levels of sandblasting.

2404.4 Other designs. For designs outside the scope of this section, an analysis or test data for the specific installation shall be prepared by a registered design professional.

SECTION 2405
SLOPED GLAZING AND SKYLIGHTS

2405.1 Scope. This section applies to the installation of glass and other transparent, translucent or opaque glazing material installed at a slope more than 15 degrees (0.26 rad) from the vertical plane, including glazing materials in skylights, roofs and sloped walls.

2405.2 Allowable glazing materials and limitations. Sloped glazing shall be any of the following materials, subject to the listed limitations.

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer, wired glass, light-transmitting plastic materials meeting the requirements of Section 2607, heat-strengthened glass or fully tempered glass.
2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in Item 1 above.

Annealed glass is permitted to be used as specified within Exceptions 2 and 3 of Section 2405.3.

For additional requirements for plastic skylights, see Section 2610. Glass-block construction shall conform to the requirements of Section 2101.2.5.

2405.3 Screening. Where used in monolithic glazing systems, heat-strengthened glass and fully tempered glass shall have screens installed below the glazing material. The screens and their fastenings shall: (1) be capable of supporting twice the weight of the glazing; (2) be firmly and substantially fastened to the framing members and (3) be installed within 4 inches (102 mm) of the glass. The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gage (0.0808 inch) with mesh not larger than 1 inch by 1 inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent noncorrosive screen materials shall be used. Heat-strengthened glass, fully tempered glass and wired glass, when used in multiple-layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening that conforms to the requirements for monolithic glazing systems.

Exception: In monolithic and multiple-layer sloped glazing systems, the following applies:

1. Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass 10 feet (3048 mm) or less above the walking surface.
2. Screens are not required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.
3. Any glazing material, including annealed glass, is permitted to be installed without screens in the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 feet (9144 mm) above grade.
4. Screens shall not be required within individual dwelling units in Groups R-2, R-3 and R-4 where fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and the following conditions are met:
   4.1. Each pane of the glass is 16 square feet (1.5 m^2) or less in area.
   4.2. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.
   4.3. The glass thickness is $^3/_{16}$ inch (4.8 mm) or less.
5. Screens shall not be required for laminated glass with a 15-mil (0.38 mm) polyvinyl butyral (or equivalent) interlayer used within individual dwelling units in Groups R-2, R-3 and R-4 within the following limits:
   5.1. Each pane of glass is 16 square feet (1.5 m^2) or less in area.
   5.2. The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.

2405.4 Framing. In Type I and II construction, sloped glazing and skylight frames shall be constructed of noncombustible materials. In structures where acid fumes deleterious to metal are incidental to the use of the buildings, approved pressure-treated wood or other approved noncorrosive materials are permitted to be used for sash and frames. Framing supporting sloped glazing and skylights shall be designed to resist the tributary roof loads in Chapter 16. Skylights set at an angle of less than 45 degrees (0.79 rad) from the horizontal plane shall be mounted at least 4 inches (102 mm) above the plane of the roof on a curb constructed as required for the frame. Skylights shall not be installed in the plane of the roof where the roof pitch is less than 45 degrees (0.79 rad) from the horizontal.

Exception: Installation of a skylight without a curb shall be permitted on roofs with a minimum slope of 14 degrees (three units vertical in 12 units horizontal) in Group R-3 occupancies. All unit skylights installed in a roof with a pitch flatter than 14 degrees (0.25 rad) shall be mounted at least 4 inches (102 mm) above the plane of the roof on a curb constructed as required for the frame unless otherwise specified in the manufacturer's installation instructions.

2405.5 Unit skylights. Unit skylights shall be tested and labeled as complying with AAMA/WDMA/CSA 101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency, the product designation and the performance grade rating as specified in AAMA/WDMA/CSA 101/I.S.2/A440. If the product manufacturer has chosen to have the performance grade of the skylight rated separately for positive and negative design pressure, then the label shall state both performance grade ratings as specified in AAMA/WDMA/CSA 101/I.S.2/A440 and the skylight shall comply with Section 2405.5.2. If the skylight is not rated separately for positive and negative pressure, then the

performance grade rating shown on the label shall be the performance grade rating determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for both positive and negative design pressure and the skylight shall conform to Section 2405.5.1.

2405.5.1 Unit skylights rated for the same performance grade for both positive and negative design pressure. The design of unit skylights shall be based on the following equation:

$F_g \leq PG$ **(Equation 24-13)**

where:

F_g = Maximum load on the skylight determined from Equations 24-2 through 24-4 in Section 2404.2.

PG = Performance grade rating of the skylight.

2405.5.2 Unit skylights rated for separate performance grades for positive and negative design pressure. The design of unit skylights rated for performance grade for both positive and negative design pressures shall be based on the following equations:

$F_{gi} \leq PG_{Pos}$ **(Equation 24-14)**

$F_{go} \leq PG_{Neg}$ **(Equation 24-15)**

where:

PG_{Pos} = Performance grade rating of the skylight under positive design pressure;

PG_{Neg} = Performance grade rating of the skylight under negative design pressure; and

F_{gi} and F_{go} are determined in accordance with the following:

For $W_o \geq D$,

where:

W_o = Outward wind force, psf (kN/m^2) as calculated in Section 1609.

D = The dead weight of the glazing, psf (kN/m^2) as determined in Section 2404.2 for glass, or by the weight of the plastic, psf (kN/m^2) for plastic glazing.

F_{gi} = Maximum load on the skylight determined from Equations 24-3 and 24-4 in Section 2404.2.

F_{go} = Maximum load on the skylight determined from Equation 24-2.

For $W_o < D$,

where:

W_o = Is the outward wind force, psf (kN/m^2) as calculated in Section 1609.

D = The dead weight of the glazing, psf (kN/m^2) as determined in Section 2404.2 for glass, or by the weight of the plastic for plastic glazing.

F_{gi} = Maximum load on the skylight determined from Equations 24-2 through 24-4 in Section 2404.2.

F_{go} = 0.

SECTION 2406
SAFETY GLAZING

2406.1 Human impact loads. Individual glazed areas, including glass mirrors, in hazardous locations as defined in Section 2406.3 shall comply with Sections 2406.1.1 through 2406.1.4.

2406.1.1 CPSC 16 CFR 1201. Except as provided in Sections 2406.1.2 through 2406.1.4, all glazing shall pass the test requirements of CPSC 16 CFR 1201, listed in Chapter 35. Glazing shall comply with the CPSC 16 CFR, Part 1201 criteria, for Category I or II as indicated in Table 2406.1.

2406.1.2 Plastic glazing. Plastic glazing shall meet the weathering requirements of ANSI Z97.1.

2406.1.3 Glass block. Glass-block walls shall comply with Section 2101.2.5.

2406.1.4 Louvered windows and jalousies. Louvered windows and jalousies shall comply with Section 2403.5.

2406.2 Identification of safety glazing. Except as indicated in Section 2406.2.1, each pane of safety glazing installed in hazardous locations shall be identified by a manufacturer's designation specifying who applied the designation, the manufacturer or installer and the safety glazing standard with which it complies, as well as the information specified in Section 2403.1. The designation shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that once applied, cannot be removed without being destroyed. A label as defined in Section 1702.1 and meeting the requirements of this section shall be permitted in lieu of the manufacturer's designation.

Exceptions:

1. For other than tempered glass, manufacturer's designations are not required, provided the building official

TABLE 2406.1
MINIMUM CATEGORY CLASSIFICATION OF GLAZING

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category class)	GLAZING IN DOORS (Category class)	GLAZED PANELS REGULATED BY ITEM 7 OF SECTION 2406.3 (Category class)	GLAZED PANELS REGULATED BY ITEM 6 OF SECTION 2406.3 (Category class)	DOORS AND ENCLOSURES REGULATED BY ITEM 5 OF SECTION 2406.3 (Category class)	SLIDING GLASS DOORS PATIO TYPE (Category class)
9 square feet or less	I	I	No requirement	I	II	II
More than 9 square feet	II	II	II	II	II	II

For SI: 1 square foot = 0.0929m^2.

approves the use of a certificate, affidavit or other evidence confirming compliance with this code.

2. Tempered spandrel glass is permitted to be identified by the manufacturer with a removable paper designation

2406.2.1 Multilight assemblies. Multilight glazed assemblies having individual lights not exceeding 1 square foot (0.09 m^2) in exposed areas shall have at least one light in the assembly marked as indicated in Section 2406.2. Other lights in the assembly shall be marked "CPSC 16 CFR 1201."

2406.3 Hazardous locations. The following shall be considered specific hazardous locations requiring safety glazing materials:

1. Glazing in swinging doors except jalousies (see Section 2406.3.1).
2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
3. Glazing in storm doors.
4. Glazing in unframed swinging doors.
5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any portion of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above a standing surface.
6. Glazing in an individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the walking surface.

   Exceptions:

   1. Panels where there is an intervening wall or other permanent barrier between the door and glazing.
   2. Where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. Glazing in this application shall comply with Section 2406.3, Item 7.
   3. Glazing in walls perpendicular to the plane of the door in a closed position, other than the wall towards which the door swings when opened, in one- and two-family dwellings or within dwelling units in Group R-2.

7. Glazing in an individual fixed or operable panel, other than in those locations described in preceding Items 5 and 6, which meets all of the following conditions:

   7.1. Exposed area of an individual pane greater than 9 square feet (0.84 m^2);

   7.2. Exposed bottom edge less than 18 inches (457 mm) above the floor;

   7.3. Exposed top edge greater than 36 inches (914 mm) above the floor; and

   7.4. One or more walking surface(s) within 36 inches (914 mm) horizontally of the plane of the glazing.

   Exception: Safety glazing for Item 7 is not required for the following installations:

   1. A protective bar $1^1/_2$ inches (38 mm) or more in height, capable of withstanding a horizontal load of 50 pounds plf (730 N/m) without contacting the glass, is installed on the accessible sides of the glazing 34 inches to 38 inches (864 mm to 965 mm) above the floor.
   2. The outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet (7620 mm) or more above any grade, roof, walking surface or other horizontal or sloped (within 45 degrees of horizontal) (0.78 rad) surface adjacent to the glass exterior.

8. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface.
9. Glazing in walls and fences enclosing indoor and outdoor swimming pools, hot tubs and spas where all of the following conditions are present:

   9.1. The bottom edge of the glazing on the pool or spa side is less than 60 inches (1524 mm) above a walking surface on the pool or spa side of the glazing; and

   9.2. The glazing is within 60 inches (1524 mm) horizontally of the water's edge of a swimming pool or spa.

10. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface; when the exposed surface of the glass is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.
11. Glazing adjacent to stairways within 60 inches (1524 mm) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60 inches (1524 mm) above the nose of the tread.

    Exception: Safety glazing for Item 10 or 11 is not required for the following installations where:

    1. The side of a stairway, landing or ramp which has a guardrail or handrail, including balusters or in-fill panels, complying with the provisions of Sections 1013 and 1607.7; and
    2. The plane of the glass is greater than 18 inches (457 mm) from the railing.

2406.3.1 Exceptions. The following products, materials and uses shall not be considered specific hazardous locations:

1. Openings in doors through which a 3-inch (76 mm) sphere is unable to pass.
2. Decorative glass in Section 2406.3, Item 1, 6 or 7.
3. Glazing materials used as curved glazed panels in revolving doors.
4. Commercial refrigerated cabinet glazed doors.
5. Glass-block panels complying with Section 2101.2.5.
6. Louvered windows and jalousies complying with the requirements of Section 2403.5.
7. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

2406.4 Fire department access panels. Fire department glass access panels shall be of tempered glass. For insulating glass units, all panes shall be tempered glass.

SECTION 2407
GLASS IN HANDRAILS AND GUARDS

2407.1 Materials. Glass used as a handrail assembly or a guard section shall be constructed of either single fully tempered glass, laminated fully tempered glass or laminated heat-strengthened glass. Glazing in railing in-fill panels shall be of an approved safety glazing material that conforms to the provisions of Section 2406.1.1. For all glazing types, the minimum nominal thickness shall be $^1/_4$ inch (6.4 mm). Fully tempered glass and laminated glass shall comply with Category II of CPSC 16 CFR 1201, listed in Chapter 35.

2407.1.1 Loads. The panels and their support system shall be designed to withstand the loads specified in Section 1607.7. A safety factor of four shall be used.

2407.1.2 Support. Each handrail or guard section shall be supported by a minimum of three glass balusters or shall be otherwise supported to remain in place should one baluster panel fail. Glass balusters shall not be installed without an attached handrail or guard.

2407.1.3 Parking garages. Glazing materials shall not be installed in handrails or guards in parking garages except for pedestrian areas not exposed to impact from vehicles.

SECTION 2408
GLAZING IN ATHLETIC FACILITIES

2408.1 General. Glazing in athletic facilities and similar uses subject to impact loads, which forms whole or partial wall sections or which is used as a door or part of a door, shall comply with this section.

2408.2 Racquetball and squash courts.

2408.2.1 Testing. Test methods and loads for individual glazed areas in racquetball and squash courts subject to impact loads shall conform to those of CPSC 16 CFR, Part 1201, listed in Chapter 35, with impacts being applied at a height of 59 inches (1499 mm) above the playing surface to an actual or simulated glass wall installation with fixtures, fittings and methods of assembly identical to those used in practice.

Glass walls shall comply with the following conditions:

1. A glass wall in a racquetball or squash court, or similar use subject to impact loads, shall remain intact following a test impact.
2. The deflection of such walls shall not be greater than $1^1/_2$ inches (38 mm) at the point of impact for a drop height of 48 inches (1219 mm).

Glass doors shall comply with the following conditions:

1. Glass doors shall remain intact following a test impact at the prescribed height in the center of the door.
2. The relative deflection between the edge of a glass door and the adjacent wall shall not exceed the thickness of the wall plus $^1/_2$ inch (12.7 mm) for a drop height of 48 inches (1219 mm).

2408.3 Gymnasiums and basketball courts. Glazing in multipurpose gymnasiums, basketball courts and similar athletic facilities subject to human impact loads shall comply with Category II of CPSC 16 CFR 1201, listed in Chapter 35.

SECTION 2409
GLASS IN ELEVATOR HOISTWAY

2409.1 Glass in elevator enclosures. Glass in elevator enclosures shall be laminated glass conforming to ANSI Z97.1 or 16 CFR Part 1201. Markings as specified in the applicable standard shall be on each separate piece of glass and shall remain visible after installation.

SECTION 2410
HIGH-VELOCITY HURRICANE ZONES — GENERAL

2410.1 Exterior wall cladding, surfacing and glazing, where provided, shall be as set forth in Sections 2410 through 2415.

2410.2 Exterior wall cladding, surfacing and glazing shall be designed and constructed to sufficiently resist the full pressurization from the wind loads prescribed in Chapter 16 (High-Velocity Hurricane Zones) and the concentrated loads that result from hurricane-generated wind-borne debris.

1. Exterior wall cladding, surfacing and glazing, within the lowest 30 feet (9.1 m) of the exterior building walls shall be of sufficient strength to resist large missile impacts as outlined in Chapter 16 (High-Velocity Hurricane Zones).
2. Exterior wall cladding, surfacing and glazing located above the lowest 30 feet (9.1 mm) of the exterior building walls shall be of sufficient strength to resist small missile impacts as outlined in Chapter 16 (High-Velocity Hurricane Zones).

Exception: Exterior wall cladding, surfacing and glazing when protected by fixed, operable or portable shutters or screens which have product approval to resist full pressurization from wind loads as well as large and small missile impacts as outlined in the high-velocity hurricane provisions of Chapter 16, without deforming to the point where the substrate being protected is compromised.

2410.3 Workmanship. Cladding and glazing shall be in conformance with the tolerances, quality and methods of construction as set forth in the standard referenced in Chapter 35.

2410.4 All exterior wall cladding, surfacing, garage doors, skylights, operative and inoperative windows shall have Product Approval.

SECTION 2411
HIGH-VELOCITY HURRICANE ZONES—WINDOWS, DOORS, GLASS AND GLAZING

2411.1 General.

2411.1.1 Windows, doors, glass and glazing shall be as set forth in this section.

2411.1.2 Glass shall comply with ASTM C 1036 requirements for flat glass Type I and II and GSA DD-G-451c *Standard for Glass, Flat and Corrugated, for Glazing Mirrors and Other Uses.*

2411.1.3 Tempered glass shall comply with 16 CFR 1201.

2411.1.4 Transparent and obscure safety glazing shall conform to the *Performance Specifications and Methods of Test for Transparent Safety Glazing Materials Used in Buildings, ANSI Z 97.1.*

2411.1.5 Heat-strengthened and ceramic-coated spandrel glass shall comply with ASTM C 1048.

2411.1.6 Wired glass shall comply with ANSI Z 97.I and shall only be used in fire doors and in glazed panels where safety glazing is not required.

2411.1.7 Installed glass shall not be less than Single-Strength B quality unless otherwise approved by the building official, and where edges are exposed they shall be seamed or ground.

2411.1.8 Where a light of glass is of such height above grade that the top 50 percent or more is in a zone of greater wind load, the area of the entire light shall be limited as for the greater height above grade.

2411.1.9 Replacement of any glazing or part thereof shall be designed and constructed in accordance with Chapter 34, Existing Buildings Provisions for High-Velocity Hurricane Zones.

2411.1.10 Replacement of glazing of more than one light or more than 30 percent of the total area glazed shall conform to the requirements of the section.

2411.1.11 Fixed glazing used as an exterior component shall require product approval. Rational analysis by a Florida-registered engineer or architect may be accepted when the actual pressure and geometry conditions differ from the conditions shown in the approval.

2411.2 Fixed glass in exterior walls.

2411.2.1 Limits of size of glass.

2411.2.1.1 The minimum thickness of annealed float glazing materials used in exterior walls shall be determined and shall not be less than as set forth in ASTM E 1300.

2411.2.1.2 For glazing materials other than annealed float use the glazing material resistance factors used in ASTM E 1300.

2411.2.1.3 Corrugated glass and other special glass shall be limited to spans determined by analysis and test to resist the loads set forth in Chapter 16 (High Wind Zones) based on fiber stresses not exceeding 4000 psi (27.58 MPa).

2411.2.1.4 Glass block shall have product approval.

2411.3 Doors and operative windows in exterior walls.

2411.3.1 Design and approval.

2411.3.1.1 The design and approval of sliding doors, swinging doors and operative windows in exterior walls, including the supporting members shall be based on the proposed use-height above grade in accordance with Chapter 16 (High-Velocity Hurricane Zones).

2411.3.1.2 Maximum glass sizes shall comply with ASTM E 1300.

2411.3.1.3 Glazing in sliding and in swinging doors shall be safety-glazing complying with 16 CFR 1201, *Safety Standard for architectural glazing Materials, Consumer Product Safety Commission,* and as described in Sections 2411.3.1.3.1 through 2411.3.1.3.5.

2411.3.1.3.1 Doors containing glazing material not greater than 9 square feet (0.84 m^2) in surface area shall be classified as Category I glazing products.

2411.3.1.3.2 Doors, bath and shower enclosures, and sliding glass doors containing glazing material greater than 9 square feet (0.84 m^2) in surface area shall be classified as Category II glazing products.

2411.3.1.3.3 Category I glazing products shall be capable of withstanding a 150 foot-pound (102 N-m) impact test.

2411.3.1.3.4 Category II glazing products shall be capable of withstanding a 400 foot-pound (542 N-m) impact test.

2411.3.1.3.5 Doors shall be designed to be readily operative without contact with the glass.

2411.3.1.4 The architect or professional engineer of record shall be required to specify the design wind pressure, determined in accordance with Chapter 16 (High-Velocity Hurricane Zones), for all garage doors, skylights operative windows and fixed glazing. The design wind pressure for each component of the exterior building surface, shall be incorporated into the building design drawing so as to allow the respective manufacturer to size the prefabricated assembly for the proper wind pressures.

2411.3.1.5 Exterior garage doors shall be designed and constructed to actively or passively lock in the closed position when subjected to a uniform lateral pressure in excess of 50 percent of the design wind pressure as prescribed in Chapter 16 (High-Velocity Hurricane Zones).

2411.3.1.6 The architect or professional engineer of record shall be required to detail on the drawings submitted for permit, rough opening dimensions, supporting framework, method of attachment and waterproofing procedures for all garage doors, passage doors, skylights, operative and inoperative windows in exterior walls. Said framework and method of attachment shall be designed and constructed so as to sufficiently resist the design wind pressures as outlined in Chapter 16 (High-Velocity Hurricane Zones).

Exception: When detailed engineered shop drawings, along with the notices of product approval, produced by the manufacturer's specialty engineer and approved by the architect or professional engineer of record, are admitted at the time of permit application, which completely identifies rough openings, supporting framework, method of attachment and waterproofing procedures are prepared and bear the signature and seal of a professional engineer.

2411.3.2 Tests.

2411.3.2.1 Operative window and door assemblies shall be tested in accordance with the requirements of this section, TAS 202 and provisions from ANSI/AAMA/MWWDA 101/IS 2, and the forced entry prevention requirements of the American Architectural Manufacturers Association (AAMA) Sections 1302.5 and 1303.5.

Exceptions:

1. Door assemblies installed in nonhabitable areas where the door assembly and area are designed to accept water infiltration, need not be tested for water infiltration.
2. Door assemblies installed where the overhang (OH) ratio is equal to or more than 1 need not be tested for water infiltration. The overhang ratio shall be calculated by the following equation:

   OH ratio = OH Length/OH Height

   where:

   OH length = The horizontal measure of how far an overhang over a door projects out from door's surface.

   OH height = The vertical measure of the distance from the door's sill to the bottom of the overhang over a door.
3. Pass-through windows for serving from a single-family kitchen, where protected by a roof overhang of 5 feet (1.5 m) or more shall be exempted from the requirements of the water infiltration test.

2411.3.2.1.1 Glazed curtain wall, window wall and storefront systems shall be tested in accordance with the requirements of this Section and the laboratory test requirements of the American Architectural Manufacturers Association (AAMA) Standard 501, following test load sequence and test load duration in TAS 202.

2411.3.2.2 Such assemblies with permanent muntin bars shall be tested with muntin bars in place.

2411.3.2.3 Such assemblies shall be installed in accordance with the conditions of test and approval.

2411.3.2.4 Test loads for inward and outward pressures shall be equal to the velocity pressures for the appropriate height in accordance with Chapter 16 (High-Velocity Hurricane Zones) as further modified by a factor of 1.5.

2411.3.2.5 Comparative analysis of operative windows and glazed doors may be made provided the proposed unit complies with the following:

1. Shall always be compared with a tested and currently approved unit.
2. Varies only in width, height and/or load requirements.
3. Shall not exceed 100 percent of the proportional deflection for fiber stress of the intermediate members of the approved unit.
4. Shall conform as to extruded members, reinforcement and in all other ways with the tested approved unit.
5. Shall not exceed 100 percent of the concentrated load at the juncture of the intermediate members and the frame of the approved unit.
6. Shall not permit more air and water infiltration than the approved unit based on the height above grade.
7. Compared unit shall not exceed the maximum cyclic pressure when tested per TAS 203.

2411.3.2.6 Comparative analysis of fixed glass windows may be made provided the proposed unit complies with the following:

1. Shall always be compared with a tested and currently approved unit.
2. Varies only in width, height and/or load requirements.
3. The design is identical in all respects. e.g., extrusions, glazing system, joinery, fasteners, etc.
4. Shall not permit more air and water infiltration than the approved unit based on height above grade.
5. The maximum uniform load distribution (ULD) of any side is equal to the uniform load carried by the side divided by the length of the side.
6. The ULD of any member must not exceed the ULD of the corresponding member of the tested window.
7. The uniform load distribution on each member shall be calculated in accordance to Section 2, Engineering Design Rules, of the AAMA 103.3 *Procedural Guide*.
8. Compared unit shall not exceed the maximum cyclic pressure when tested per TAS 203.

2411.3.3 Construction details. Construction details for fixed glass shall comply with the requirements of this paragraph except that structural glazing as defined in Section 202 need not comply with this section, but shall comply with Section 2415.

2411.3.3.1 Each light of fixed glass more than 3 feet (914 mm) in width shall have two approved setting blocks or approved suspension clamps. Setting blocks shall be Neoprene 70-90 Shore A durometer hardness or approved equal.

2411.3.3.2 Fixed glass lights shall be set in corrosion-resistant metal frames and shall comply with applicable requirements of Chapter 16 (High-Velocity Hurricane Zones) for wind loads, allowable stresses and load tests. Fixed glass lights may be set in wood, metal or concrete frames as permitted for the types of construction by Chapter 3 through Chapter 6.

2411.3.3.3 Wood shall have been preservative treated or shall be of a durable species as defined in Section 2326.2.

2411.3.3.4 Attachment shall be as set forth in Chapter 16 (High-Velocity Hurricane Zones) and shall be corrosion-resistant.

2411.3.3.5 Glass in fixed lights shall be securely and continuously supported at the perimeter of each sheet unless the design is based on one or more unsupported edges. Supporting members such as division bars and mullions shall be designed by rational analysis to support the wind pressures set forth in Chapter 16 (High-Velocity Hurricane Zones). Supporting bars shall be attached at the ends to resist the loads set forth in Chapter 16 (High-Velocity Hurricane Zones).

2411.3.3.6 The depth of the glazing rabbet and depth of engagement in the rabbet, for fixed glass, shall be based on consideration of the dimensional reduction from deflection and the dimensional changes caused by temperature.

2411.3.3.7 Exterior lite of glass in an insulated glass unit shall be safty glazed.

Exceptions:

1. Large missile impact-resistant glazed assemblies.
2. Nonmissile impact units protected with shutters.

2411.3.4 Gaskets used in glazing systems shall comply with the following standards as applicable:

1. ASTM C 864, Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
2. ASTM C 509, Elastomeric Cellular Preformed Gaskets and Sealing Material.
3. ASTM C 1115, Dense Elastomeric Silicone Rubber Gaskets and Accessories.
4. ASTM E 2203, Dense Thermoplastic Elastomers Used for Compression Seals, Gaskets, Setting Blocks, Spacers and Accessories.

2411.4 Glazed panel safeguards. Glazed panels shall be protected in accordance with this section.

2411.4.1 Where there is a drop of 4 feet (1219 mm) or more on the far side of fixed glazed panel 24 inches (610 mm) or more in width, the bottom of which is less than 36 inches (914 mm) above the near side walking surface, safeguards as set forth in Section 1618.4 shall be provided.

2411.4.2 Where there is a drop of less than 4 feet (1219 mm) on opposite sides of an operable or nonoperable glazed panel 24 inches (610 mm) or more in width and 9 square feet (0.84 m^2) or more in area, one of the following safeguards shall be provides where persons might walk into or through such glazing:

1. Safety glazing conforming to federal standard 16 CFR 1201.
2. An opaque bulkhead not less than 18 inches (457 mm) higher than the upper level.
3. A single horizontal bar of handrail strength requirements not less than $1^1/_2$ inches (38 mm) in width measured parallel to the plane of the glazing and located between 24 inches and 36 inches (610 and 914 mm) above the upper level.
4. A planter with plantings not less than 18 inches (457 mm) higher than the upper level.

2411.4.3 Glazed panels located adjacent to, or in doors, shall be of safety glazing, in accordance with the following:

1. All glazed panels through which a 3-inch-diameter (76 mm) sphere is able to pass.
2. In all occupancies, any glazing material adjacent to door within 48 inches (1219 mm) of the door in the closed position and below the top of the door.

Exceptions:

1. Wired glass in fire doors.
2. Leaded glass of 30 square inches (.02 m^2) or less.
3. Curved glass in revolving doors.
4. Commercial refrigerated cabinet doors.
5. A solar screen may serve as a safeguard where such screen complies with strength requirements of railings.

2411.5 Operable window safeguards. Operable windows shall be protected in accordance with this section.

2411.5.1 Where there is a drop of more than 4 feet (1219 mm) on the far side of such windows and the sill is less than 36 inch (914 mm) above the near side walking surface, safeguards shall be provided to prevent the fall of persons when such windows are open as set forth in Section 1618.4.

Exceptions:

1. Where the vent openings are 12 inches (305 mm) or less in least dimension and are restricted in operation to reject objects as required for safeguard in Section 1618.4.
2. Slats or grillwork constructed to comply with Standard OSHA-1910, set forth in Section 1618.4

or other construction approved by the building official, may be provided in lieu of other safeguards.

3. Where the near side of such windows is less than 4 inches (102 mm) above the floor and falling objects could present a hazard, toeboards shall be provided as required by 29 CFR 1910.
4. Alternate approved designs.

2411.5.2 Where the drop from such windows is less than 4 feet (1219 mm) or where such windows are adjacent to a door, the glazing shall comply with the Sections 2411.4.2 and 2411.4.3.

2411.6 Interior locations.

2411.6.1 Swinging or sliding doors of glass without a continuous frame shall be of only fully tempered glass not less than $^3/_8$ inch (9.5 mm) in thickness.

2411.6.2 Safeguards. The glazing in sliding and swinging doors and in shower to tub enclosures, including any glazing within 60 inches (1.5 m) of the finished floor surface in walls surrounding any tub or shower enclosure, shall be safety glazing as set forth in Section 2411.3.1.3 for Category II glazing products.

2411.6.3 Glass or mirrors immediately surrounding a bathtub or shower enclosure shall be safety glazing where the glass or mirrors are less than 60 inches (1.5 m) above the floor of the tub or the shower.

2411.6.4 The glazing in fixed panels adjacent to paths of egress shall comply with Section 2411.4.3.

2411.6.5 Glass shall not be solid painted or otherwise concealed where such painted glass may be mistaken for other construction materials.

2411.6.6 Glass mirrors of more than 9 square feet (0.84 m^2) in area that are used as surface finish material on walls in public spaces shall be directly secured to supports and shall not be hung.

2411.7 Safety glazing.

2411.7.1 Safety glazing, where required, shall be as set forth in this section.

2411.7.2 Safety glazing shall comply with the standard set forth in Section 2411.1.4 for transparent and obscure safety-glazing materials, and plastic glazing shall in addition comply with the specifications of Section 2411.7.3.

2411.7.3 Plastics, with or without reinforcing or acrylic modifiers shall comply with Section 2612, and consideration of dimension reduction caused by deflection and/or dimensional instability of the materials shall be given in the determination of the depth of the glazing rabbet and engagement of the plastic in the rabbet. Plastics shall be limited to spans determined by analysis and test to resist the loads set forth in Chapter 16 (High-Velocity Hurricane Zones).

2411.7.4 Glass louvered doors need not be safety glazed.

2411.8 Sloped glazing.

2411.8.1 Sloped glazing includes any installation of glass or other transparent, translucent or opaque glazing material installed at a slope of 15 degrees (0.26 rad) or more from the vertical plane. Glazing materials in skylights, roofs and sloped walls are included with this definition.

2411.8.2 Allowable glazing materials. Sloped glazing shall be any of the following materials subject to the limitations specified in Section 2411.8.3.

2411.8.2.1 For monolithic glazing systems, the glazing material of the single light or layer shall be laminated with a minimum 30 mil polyvinyl butyryl (or equivalent) interlayer, wire glass, approved plastic material meeting the requirements of this chapter, heat strengthened glass or fully tempered glass.

2411.8.2.2 For multiple glazing systems, each light or layer shall consist of any glazing materials specified in Section 2411.8.2.1.

2411.8.2.3 See Section 2612 for additional requirements for plastic skylights.

2411.8.3 Limitations. Heat strengthened and fully tempered glass when used in monolithic glazing systems shall have screens installed below the glazing material to protect building occupants from falling glass should breakage occur. The screens shall be capable of supporting the weight of the glass and shall be substantially supported below and installed within 4 inches (102 mm) of the glass. They shall be constructed of a noncombustible material not thinner than 0.0808 inch (2 mm) (12 B and S gauge) diameter with a mesh not larger than 1 inch by 1 inch (25 mm by 25 mm). In a corrosive atmosphere structurally equivalent corrosion-resistant screening materials shall be used. Heat-strengthened glass, fully tempered glass and wire glass, when used in multiple glazing systems as the bottom layer over the walking surface, shall be equipped with screening meeting the requirements for monolithic glazing systems.

Exceptions:

1. In monolithic and multiple-layer sloped glazing systems, any glazing material, including annealed glass, may be installed without required screens if the walking surface below the glazing material is permanently protected from the risk of falling glass or if the area below the glazing material is not a walking surface.
2. In monolithic and multiple layer sloped glazing systems, any glazing material, including annealed glass, may be installed in the sloped glazing systems of greenhouses (structures used primarily for growing plants) without screens provided the height of the penthouse at the ridge does not exceed 20 feet (6.1 m) above grade. Frames may be of wood construction in greenhouses located outside the fire district if the height of the sloped glazing does not exceed 20 feet (6.1 m) above grade. In other cases, noncombustible frames shall be used.

2411.8.4 Sloped glazed framing. In other than Types IV II-B and III-B construction, all sloped glazing skylight frames shall be constructed of noncombustible materials. In foundries or buildings where acid fumes deleterious to

metal are incidental to the use of the building, approved pressure treated woods or other approved noncombustible material shall be permitted for sash and frames. All sloped glazing and skylights shall be designed for the roof and wind loads in Chapter 16 (High-Velocity Hurricane Zones). All skylights set at an angle of less than 45 degrees (0.79 rad) from the horizontal shall be mounted at least 4 inches (102 mm) above the planer of the roof on a curb construction as required for the frame. Sloped glazing may be installed in the plane of the roof where the roof pitch is greater than 45 degrees (0.79 rad) from the horizontal.

SECTION 2412
HIGH-VELOCITY HURRICANE ZONES—GLASS VENEER

2412.1 Glass veneer shall be as set forth in this section.

2412.2 Dimension. Glass veneer units shall be not less than $^{11}/_{32}$ inch (8.7 mm) in thickness. No unit shall be larger in area than 10 square feet (0.93 m^2) where 15 feet (4.6 m) or less above the grade directly below, nor larger than 6 square feet (0.56 m^2) where more than 15 feet (4.6 m) above the grade directly below.

2412.3 Attachment. Every glass veneer unit shall be attached to the backing with approved mastic cement and corrosion-resistant ties and shall be supported on shelf angles.

2412.3.1 Where more than 6 feet (1829 mm) above grade, veneer shall be supported by shelf angles, and ties shall be used in both horizontal and vertical joints.

2412.3.2 Below a point 6 feet (1829 mm) above grade, glass veneer shall rest on shelf angles. Veneering shall not be supported on construction which is not an integral part of the wall, and over sidewalks shall be supported on a shelf angle not less than $^1/_4$ inch (6.4 mm) above grade.

2412.3.3 All edges of glass veneer shall be ground.

2412.4 Mastic.

2412.4.1 The mastic shall cover not less than one-half of the area of the unit after the unit has been set in place and shall be neither less than $^1/_4$ inch (6.4 mm) nor more than $^1/_2$ inch (12.7 mm) in thickness.

2412.4.2 The mastic shall be insoluble in water and shall not lose its adhesive qualities when dry.

2412.4.3 Absorbent surfaces shall be sealed by a bonding coat before mastic is applied. The bonding coat shall be cohesive with the mastic.

2412.4.4 Glass veneer surfaces to which mastic is applied shall be clean and uncoated.

2412.4.5 Space between edges of glass veneer shall be filled uniformly with an approved type pointing compound.

2412.5 Shelf angles and ties.

2412.5.1 Shelf angles shall be of corrosion-resistant material capable of supporting four times the width of the supported veneer. The shelf angles shall be spaced vertically in alternate horizontal joints, but not more than 3 feet (914 mm) apart. Shelf angles shall be secured to the wall at intervals not exceeding 2 feet (610 mm) with corrosion-resistant bolts not less than $^1/_4$ inch (6.4 mm) diameter. Bolts shall be set in masonry and secured by lead shields.

2412.5.2 Ties shall be of corrosion resistant metal as manufactured especially for holding glass-veneer sheets to masonry surfaces. There shall be not less than one such approved tie for each 2 square feet (0.19 m^2) of veneer surface.

2412.6 Backing. Exterior glass veneer shall be applied only upon masonry, concrete or stucco.

2412.7 Expansion joints. Glass veneer units shall be separated from each other and from adjoining materials by an expansion joint at least $^1/_{16}$ inch (1.6 mm) in thickness. There shall be at least $^1/_{64}$ inch (0.4 mm) clearance between bolts and the adjacent glass.

SECTION 2413
HIGH-VELOCITY HURRICANE ZONES—STORM SHUTTERS/EXTERNAL PROTECTIVE DEVICES

2413.1 General. Unless exterior wall components including but not limited to structural glazing, doors and windows of enclosed buildings have specific Product Approval to preserve the enclosed building envelope against impact loads as set forth in Chapter 16 (High-Velocity Hurricane Zones), all such components shall be protected by product approved storm shutters.

2413.2 The storm shutters shall be designed and constructed to insure a minimum of 1 inch (25 mm) separation at maximum deflection with components and frames of components they are to protect unless the components and frame are specifically designed to receive the load of storm shutters, and shall be designed to resist the wind pressures as set forth in Chapter 16 (High-Velocity Hurricane Zones) by methods admitting of rational analysis based on established principles of design. Storm shutter shall also be designed to comply with the impact load requirements included within Chapter 16 (High-Velocity Hurricane Zones).

2413.3 The storm shutter design calculations and detailed drawings, including attachment to the main structure, shall be prepared by and bear the seal of a qualified Florida-registered delegated engineer, or if qualified to prepare such design, by the engineer or architect of record, which architect or engineer shall be proficient in structural design. The architect or engineer of record shall, in all instances, review and approve documents prepared by the delegated engineer.

2413.4 Storm shutters shall be approved by the certification agency and shall bear the name of the company engraved in every section of the system.

2413.5 Deflection shall not exceed the limits set forth in Chapter 16 (High-Velocity Hurricane Zones).

2413.6 Unless storm shutters are permanently attached to the main structure, all such storm shutters shall, where practicable, be neatly stored at all times in a designated and accessible area within the building.

2413.6.1 Shutters used to protect openings above the first story of any building or structure must be permanently installed and closable from the inside of the building or

structure unless such openings are accessible without the use of a ladder or lift, or shutters can be installed from the interior of the building or structure.

Exception: Group R3 detached single-family residences not exceeding two stories.

2413.7 Storm shutters must completely cover an opening in all directions.

2413.7.1 On any side of an opening, the maximum side clearance between the shutter and a wall or inset surface shall be $^1/_4$ inch (6.4 mm). Any distance in excess of $^1/_4$ inch (6.4 mm) shall require end closure or shutter overlap, where applicable.

2413.7.2 Shutter overlap shall be a minimum of 1.5 times the side clearance between the shutter and wall.

2413.7.3 End closures shall be designed to resist wind loads specified in Chapter 16 (High-Velocity Hurricane Zones), based on rational analysis.

SECTION 2414
HIGH-VELOCITY HURRICANE ZONES—CURTAIN WALLS

2414.1 Scope. This section prescribes requirements for curtain walls of buildings or structures regulated by this code.

2414.2 Definition. A curtain wall is any prefabricated assembly of various components to enclose a building usually attached to and/or supported by the building frame other than a single door, or window, masonry units, poured in place concrete and siding of single membrane metal, wood or plastic.

2414.3 Curtain walls, as defined in Section 2414.2, shall be designed and constructed in accordance with the requirements of this section.

2414.4 Structural glazing in curtain walls shall also comply with the requirements of Section 2415.

2414.5 General.

2414.5.1 All structural elements of curtain wall systems and their attachments (including embedments) to the main structural frame shall be designed by and bear the seal of a qualified Florida-registered delegated engineer, or if qualified to prepare such design, by the engineer or architect of record, which architect or engineer shall be proficient in structural design. The engineer of record shall, in all instances, review and approve documents prepared by the delegated engineer.

2414.5.2 Curtain wall systems supported from more than two adjacent floors shall be designed to withstand all imposed loads without exceeding allowable stresses in the event of destruction or failure of any single span within the system. Documents for the main building permit shall include sufficient details describing the curtain wall system attachment to the main structure. This portion of the contract documents, if not prepared by the qualified engineer or architect of record, shall bear the signature and seal of the qualified Florida-registered delegated engineer charged with the responsibility for the design of the curtain wall system.

2414.5.3 Individual mullions acting as a continuous member shall transfer loads through supports from no more than three adjacent floors.

2414.5.4 Materials. The materials used in any curtain wall shall comply with the applicable provisions of this code.

2414.6 Fire protection.

2414.6.1 Curtain wall supports, spandrel panels, anchors and the connections at the intersection of the floor and wall shall be fire protected based on building distance separation as required in this code.

2414.6.2 Irrespective of distance separation, anchors, embedded hardware, connections at the intersection of the wall and floor and other connectors used to attach the curtain wall framing system to the building frame shall be provided with fire protection from the floor below with fire-resistant materials having a fire rating equivalent to that of the floor.

2414.6.3 Reserved.

2414.6.4 Openings between curtain wall systems and fire resistive floors shall be protected against the passage of fire and smoke in accordance with Section 2414.6.2

2414.6.5 Where fire safing is used to achieve such protection, it shall be installed in such a manner that it will remain in place for at least a duration equivalent to the fire-resistive rating of the floor system,

2414.7 Inspection. Curtain wall systems and their attachments to the main structure shall be inspected by a special inspector at both the point of assembly and the point of installation.

SECTION 2415
HIGH-VELOCITY HURRICANE ZONES—STRUCTURAL GLAZING SYSTEMS

2415.1 Scope. This section prescribes requirements for structural glazing systems of buildings or structures regulated by this code.

2415.2 Application.

2415.2.1 Structural glazing, as defined in Section 2414.2, shall be designed and constructed in accordance with the requirements of this section.

2415.2.2 Structural glazing systems used in curtain walls shall also comply with the requirements of Section 2414.

2415.3 Definition. The terms used in this section shall be defined as set forth in Section 202.

2415.4 Standards. Adhesives and sealants used in structural glazing systems shall comply with following standards:

ASTM C 794, Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.

ASTM C 920, Specification for Elastomeric Joint Sealants.

ASTM D 412, Test Methods for Rubber Properties in Tension.

ASTM D 624, Test Method for Rubber Property-Tear Resistance.

ASTM D 2240, Test Method for Rubber Property-Durometer Hardness.

Federal Specifications TT-S-001543A and TT-S-00230C.

ASTM E 331, Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors.

ASTM E 330, Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors.

2415.5 Design.

2415.5.1 General. Structural glazing systems shall be designed by and bear the seal of a Florida-registered professional engineer.

2415.5.2 Materials.

2415.5.2.1 Identification. All materials shall be clearly identified as to manufacturer and manufacturer's product number.

2415.5.2.2 Adhesives and sealants.

2415.5.2.2.1 Only approved silicone elastomer adhesives and sealants shall be used for fastening glass lights and other panels to curtain wall framing.

2415.5.2.2.2 Such adhesives and sealants shall be of a polymer that is 100-percent silicone.

2415.5.2.2.3 Adhesives and sealants shall have been tested in accordance with the standards set forth in Section 2415.4.

2415.5.3 Manufacturer's testing, recommendation and approval.

2415.5.3.1 Compatibility of all components and fabrication procedures of structural glazing systems shall be tested, approved and recommended in writing by the manufacturer of the adhesive; the manufacturer of the coating; whether it is anodized, baked or otherwise applied and the manufacturer of the glass panel.

2415.5.3.2 Manufacturer's testing, recommendation and approval shall address, but shall not be limited in scope by the following sections.

2415.5.3.2.1 The compatibility of the sealant with metal, glazing materials, shims, spacers, setting blocks, backer rods, gaskets and other materials.

2415.5.3.2.2 Adhesion to the designated substrates and adhesion of the substrates to the base metal.

2415.5.3.2.3 The design and structural capability of silicone joints and cross sections.

2415.5.4 Structural requirements.

2415.5.4.1 Design of structural seals.

2415.5.4.1.1 The design stress of the structural silicone shall not exceed 20 psi (138 kPa) for materials having a minimum strength of 100 psi (690 kPa) at the weakest element in the line of stress.

2415.5.4.1.2 Such design stress shall also provide for a safety factor of not less than 5.0.

2415.5.4.1.3 Safety factors greater than 5.0 shall be specified by the engineer when required or recommended by the manufacturer.

2415.5.4.1.4 The silicone structural seal shall have a maximum modulus of elasticity to allow no more than 25 percent movement of the joint width at 20 psi (138 kPa) stress.

2415.5.4.1.5 In insulating glass units, the secondary silicone seal shall be designed to withstand a minimum of one-half the design negative wind load applicable to the outboard lights.

2415.5.4.2 Bonding limits. Structural glazing shall be limited to adhesive bonding on one side or on two opposing sides of an infill glass lights or panel.

Exception: Three- or four-side bonding shall be permitted only when structural glazing units are shop fabricated and shop glazed.

2415.5.4.3 Job-site reglazing.

2415.5.4.3.1 Job-site replacement reglazing shall be permitted only when performed following a procedure approved in writing by the applicable structural silicone manufacturer.

2415.5.4.3.2 Replacement shall be performed only by individuals or firms approved or certified by the silicone manufacturer.

2415.6 Fire protection. Structural glazing in curtain walls shall be fire protected as required by Section 2414.6.

2415.7 Inspections, testing and recertification.

2415.7.1 A minimum of 1 percent of the structurally glazed panels shall be tested for load carrying capacity and sealant adhesion in accordance with Chapter 16 (High-Velocity Hurricane Zones) and ASTM E 330.

2415.7.2 Structural glazed panels shall be inspected by a Florida-registered architect or professional engineer for conformance with the approved design and installation procedures determined by the authority having jurisdiction prior to the erection of such panels and after the seal curing period established by the silicone manufacturer.

2415.7.3 It shall be the responsibility of the contractor to verify the adhesion of the cured sealant periodically throughout the application to assure compliance with the manufacturer's specifications and quality of application.

2415.7.4 Structural glazing systems on threshold buildings shall be recertified by the owner as specified by the authority having jurisdiction at six month intervals for the first year after installation. Subsequently, such systems shall be recertified every five years at regular intervals.

2415.7.5 Such recertifications shall determine the structural condition and adhesion capacity of the silicone sealant.

CHAPTER 25
GYPSUM BOARD AND PLASTER

SECTION 2501
GENERAL

2501.1 Scope.

2501.1.1 General. Provisions of this chapter shall govern the materials, design, construction and quality of gypsum board, lath, gypsum plaster and cement plaster.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 2514 through 2520.

2501.1.2 Performance. Lathing, plastering and gypsum board construction shall be done in the manner and with the materials specified in this chapter, and when required for fire protection, shall also comply with the provisions of Chapter 7.

2501.1.3 Other materials. Other approved wall or ceiling coverings shall be permitted to be installed in accordance with the recommendations of the manufacturer and the conditions of approval.

SECTION 2502
DEFINITIONS

2502.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

CEMENT PLASTER. A mixture of portland or blended cement, portland cement or blended cement and hydrated lime, masonry cement or plastic cement and aggregate and other approved materials as specified in this code.

EXTERIOR SURFACES. Weather-exposed surfaces.

GYPSUM BOARD. Gypsum wallboard, gypsum sheathing, gypsum base for gypsum veneer plaster, exterior gypsum soffit board, predecorated gypsum board or water-resistant gypsum backing board complying with the standards listed in Tables 2506.2, 2507.2 and Chapter 35.

GYPSUM PLASTER. A mixture of calcined gypsum or calcined gypsum and lime and aggregate and other approved materials as specified in this code.

GYPSUM VENEER PLASTER. Gypsum plaster applied to an approved base in one or more coats normally not exceeding $^1/_4$ inch (6.4 mm) in total thickness.

INTERIOR SURFACES. Surfaces other than weather-exposed surfaces.

WEATHER-EXPOSED SURFACES. Surfaces of walls, ceilings, floors, roofs, soffits and similar surfaces exposed to the weather except the following:

1. Ceilings and roof soffits enclosed by walls, fascia, bulkheads or beams that extend a minimum of 12 inches (305 mm) below such ceiling or roof soffits.
2. Walls or portions of walls beneath an unenclosed roof area, where located a horizontal distance from an open exterior opening equal to at least twice the height of the opening.
3. Ceiling and roof soffits located a minimum horizontal distance of 10 feet (3048 mm) from the outer edges of the ceiling or roof soffits.

WIRE BACKING. Horizontal strands of tautened wire attached to surfaces of vertical supports which, when covered with the building paper, provide a backing for cement plaster.

SECTION 2503
INSPECTION

2503.1 Inspection. Lath and gypsum board shall be inspected in accordance with Section 109.3.5.

SECTION 2504
VERTICAL AND HORIZONTAL ASSEMBLIES

2504.1 Scope. The following requirements shall be met where construction involves gypsum board, lath and plaster in vertical and horizontal assemblies.

2504.1.1 Wood framing. Wood supports for lath or gypsum board, as well as wood stripping or furring, shall not be less than 2 inches (51 mm) nominal thickness in the least dimension.

Exception: The minimum nominal dimension of wood furring strips installed over solid backing shall not be less than 1 inch by 2 inches (25 mm by 51 mm).

2504.1.2 Studless partitions. The minimum thickness of vertically erected studless solid plaster partitions of $^3/_8$-inch (9.5 mm) and $^3/_4$-inch (19.1 mm) rib metal lath or $^1/_2$-inch-thick (12.7 mm) long-length gypsum lath and gypsum board partitions shall be 2 inches (51 mm).

SECTION 2505
SHEAR WALL CONSTRUCTION

2505.1 Resistance to shear (wood framing). Wood-framed shear walls sheathed with gypsum board, lath and plaster shall be designed and constructed in accordance with Section 2306.4 and are permitted to resist wind loads.

2505.2 Resistance to shear (steel framing). Cold-formed steel-framed shear walls sheathed with gypsum board and constructed in accordance with the materials and provisions of Section 2210.5 are permitted to resist wind loads.

SECTION 2506
GYPSUM BOARD MATERIALS

2506.1 General. Gypsum board materials and accessories shall be identified by the manufacturer's designation to indicate compliance with the appropriate standards referenced in this section and stored to protect such materials from the weather.

2506.2 Standards. Gypsum board materials shall conform to the appropriate standards listed in Table 2506.2 and Chapter 35 and, where required for fire protection, shall conform to the provisions of Chapter 7.

TABLE 2506.2
GYPSUM BOARD MATERIALS AND ACCESSORIES

MATERIAL	STANDARD
Accessories for gypsum board	ASTM C 1047
Adhesives for fastening gypsum wallboard	ASTM C 557
Exterior soffit board	ASTM C 931
Fiber-reinforced gypsum panels	ASTM C 1278
Glass mat gypsum backing panel	ASTM C 1178
Glass mat gypsum substrate	ASTM C 1177
Gypsum backing board and gypsum shaftliner board	ASTM C 442
Gypsum ceiling board	ASTM C 1395
Gypsum sheathing	ASTM C 79
Gypsum wallboard	ASTM C 36
Joint reinforcing tape and compound	ASTM C 474; C 475
Nails for gypsum boards	ASTM C 514, F 547, F 1667
Predecorated gypsum board	ASTM C 960
Steel screws	ASTM C 954; C 1002
Steel studs, load bearing	ASTM C 955
Steel studs, nonload bearing	ASTM C 645
Standard specification for gypsum board	ASTM C 1396
Testing gypsum and gypsum products	ASTM C 22; C 472; C 473
Water-resistant gypsum backing board	ASTM C 630

2506.2.1 Other materials. Metal suspension systems for acoustical and lay-in panel ceilings shall conform with ASTM C 635 listed in Chapter 35.

SECTION 2507
LATHING AND PLASTERING

2507.1 General. Lathing and plastering materials and accessories shall be marked by the manufacturer's designation to indicate compliance with the appropriate standards referenced in this section and stored in such a manner to protect them from the weather.

2507.2 Standards. Lathing and plastering materials shall conform to the standards listed in Table 2507.2 and Chapter 35 and, where required for fire protection, shall also conform to the provisions of Chapter 7.

TABLE 2507.2
LATH, PLASTERING MATERIALS AND ACCESSORIES

MATERIAL	STANDARD
Accessories for gypsum veneer base	ASTM C 1047
Blended cement	ASTM C 595
Exterior plaster bonding compounds	ASTM C 932
Gypsum base for veneer plasters	ASTM C 588
Gypsum casting and molding plaster	ASTM C 59
Gypsum Keene's cement	ASTM C 61
Gypsum lath	ASTM C 37
Gypsum plaster	ASTM C 28
Gypsum veneer plaster	ASTM C 587
Interior bonding compounds, gypsum	ASTM C 631
Lime plasters	ASTM C 5; C 206
Masonry cement	ASTM C 91
Metal lath	ASTM C 847
Plaster aggregates Sand Perlite Vermiculite	 ASTM C 35; C 897 ASTM C 35 ASTM C 35
Plastic cement	ASTM C 1328
Portland cement	ASTM C 150
Steel screws	ASTM C 1002; C 954
Steel studs and track	ASTM C 645; C 955
Welded wire lath	ASTM C 933
Woven wire plaster base	ASTM C 1032

SECTION 2508
GYPSUM CONSTRUCTION

2508.1 General. Gypsum board and gypsum plaster construction shall be of the materials listed in Tables 2506.2 and 2507.2. These materials shall be assembled and installed in compliance with the appropriate standards listed in Tables 2508.1 and 2511.1, and Chapter 35.

TABLE 2508.1
INSTALLATION OF GYPSUM CONSTRUCTION

MATERIAL	STANDARD
Gypsum board	GA-216; ASTM C 840
Gypsum sheathing	ASTM C 1280
Gypsum veneer base	ASTM C 844
Interior lathing and furring	ASTM C 841
Steel framing for gypsum boards	ASTM C 754; C 1007

2508.2 Limitations. Gypsum wallboard or gypsum plaster shall not be used in any exterior surface where such gypsum

construction will be exposed directly to the weather. Gypsum wallboard shall not be used where there will be direct exposure to water or continuous high humidity conditions. Gypsum sheathing shall be installed on exterior surfaces in accordance with ASTM C 1280.

2508.2.1 Weather protection. Gypsum wallboard, gypsum lath or gypsum plaster shall not be installed until weather protection for the installation is provided.

2508.3 Single-ply application. Edges and ends of gypsum board shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Edges and ends of gypsum board shall be in moderate contact except in concealed spaces where fire-resistance-rated construction, shear resistance or diaphragm action is not required.

2508.3.1 Floating angles. Fasteners at the top and bottom plates of vertical assemblies, or the edges and ends of horizontal assemblies perpendicular to supports, and at the wall line are permitted to be omitted except on shear resisting elements or fire-resistance-rated assemblies. Fasteners shall be applied in such a manner as not to fracture the face paper with the fastener head.

2508.4 Joint treatment. Gypsum board fire-resistance-rated assemblies shall have joints and fasteners treated.

Exception: Joint and fastener treatment need not be provided where any of the following conditions occur:

1. Where the gypsum board is to receive a decorative finish such as wood paneling, battens, acoustical finishes or any similar application that would be equivalent to joint treatment.
2. On single-layer systems where joints occur over wood framing members.
3. Square edge or tongue-and-groove edge gypsum board (V-edge), gypsum backing board or gypsum sheathing.
4. On multilayer systems where the joints of adjacent layers are offset from one to another.
5. Assemblies tested without joint treatment.

2508.5 Horizontal gypsum board diaphragm ceilings. Gypsum board shall be permitted to be used on wood joists to create a horizontal diaphragm ceiling in accordance with Table 2508.5.

2508.5.1 Diaphragm proportions. The maximum allowable diaphragm proportions shall be $1^1/_2$:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted.

2508.5.2 Installation. Gypsum board used in a horizontal diaphragm ceiling shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of gypsum board shall not occur on the same joist.

2508.5.3 Blocking of perimeter edges. All perimeter edges shall be blocked using a wood member not less than 2-inch by 6-inch (51 mm by 159 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum board.

2508.5.4 Fasteners. Fasteners used for the attachment of gypsum board to a horizontal diaphragm ceiling shall be as defined in Table 2508.5. Fasteners shall be spaced not more than 7 inches (178 mm) on center (o.c.) at all supports, including perimeter blocking, and not more than $^3/_8$ inch (9.5 mm) from the edges and ends of the gypsum board.

2508.5.5 Lateral force restrictions. Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction.

SECTION 2509
GYPSUM BOARD IN SHOWERS AND WATER CLOSETS

2509.1 Wet areas. Showers and public toilet walls shall conform to Sections 1210.2 and 1210.3.

2509.2 Base for tile. Cement, fiber-cement or glass mat gypsum backers in compliance with ASTM C 1178, C 1288 or C 1325 and installed in accordance with manufacturer recommendations shall be used as a base for wall tile in tub and shower areas and wall and ceiling panels in shower areas. Water-resistant gypsum backing board shall be used as a base

TABLE 2508.5
SHEAR CAPACITY FOR HORIZONTAL WOOD FRAMED GYPSUM BOARD DIAPHRAGM CEILING ASSEMBLIES

MATERIAL	THICKNESS OF MATERIAL (MINIMUM) (inches)	SPACING OF FRAMING MEMBERS (MAXIMUM) (inches)	SHEAR VALUE[a] (plf of ceiling)	MIMIMUM FASTENER SIZE
Gypsum board	$^1/_2$	16 o.c.	90	5d cooler or wallboard nail; $1^5/_8$-inch long; 0.086-inch shank; $^{15}/_{64}$ -inch head[b]
Gypsum board	$^1/_2$	24 o.c.	70	5d cooler or wallboard nail; $1^5/_8$-inch long; 0.086-inch shank; $^{15}/_{64}$ -inch head[c]

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.59 N/m.

a. Values are not cumulative with other horizontal diaphragm values and are for short-term loading due to wind loading. Values shall be reduced 25 percent for normal loading.

b. Reserved.

c. $1^1/_4$-inch, No. 6 Type S or W screws are permitted to be substituted for the listed nails.

for tile in water closet compartment walls when installed in accordance with GA-216 or ASTM C 840 and manufacturer recommendations. Regular gypsum wallboard is permitted under tile or wall panels in other wall and ceiling areas when installed in accordance with GA-216 or ASTM C 840.

2509.3 Limitations. Water-resistant gypsum backing board shall not be used in the following locations:

1. Over a vapor retarder in shower or bathtub compartments.
2. Where there will be direct exposure to water or in areas subject to continuous high humidity.
3. On ceilings where frame spacing exceeds 12 inches (305 mm) o.c. for $^1/_2$-inch-thick (12.7 mm) water-resistant gypsum backing board and more than 16 inches (406 mm) o.c. for $^5/_8$-inch-thick (15.9 mm) water-resistant gypsum backing board.

SECTION 2510
LATHING AND FURRING FOR CEMENT PLASTER (STUCCO)

2510.1 General. Exterior and interior cement plaster and lathing shall be done with the appropriate materials listed in Table 2507.2 and Chapter 35.

2510.2 Weather protection. Materials shall be stored in such a manner as to protect such materials from the weather.

2510.3 Installation. Installation of these materials shall be in compliance with ASTM C 926 and ASTM C 1063.

2510.4 Corrosion resistance. Metal lath and lath attachments shall be of corrosion-resistant material.

2510.5 Backing. Backing or a lath shall provide sufficient rigidity to permit plaster applications.

2510.5.1 Support of lath. Where lath on vertical surfaces extends between rafters or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.

2510.5.2 Use of gypsum backing board.

2510.5.2.1 Use of gypsum board as a backing board. Gypsum lath or gypsum wallboard shall not be used as a backing for cement plaster.

Exception: Gypsum lath or gypsum wallboard is permitted, with a water-resistive barrier, as a backing for self-furred metal lath or self-furred wire fabric lath and cement plaster where either of the following conditions occur:

1. On horizontal supports of ceilings or roof soffits.
2. On interior walls.

2510.5.2.2 Use of gypsum sheathing backing. Gypsum sheathing is permitted as a backing for metal or wire fabric lath and cement plaster on walls. A water-resistive barrier shall be provided in accordance with Section 2510.6.

2510.5.3 Backing not required. Wire backing is not required under expanded metal lath or paperbacked wire fabric lath.

2510.6 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section 1404.2 and, where applied over wood-based sheathing, shall include a water-resistive vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper.

Exception: Where the water-resistive barrier that is applied over wood-based sheathing has a water resistance equal to or greater than that of 60-minute Grade D paper and is separated from the stucco by an intervening, substantially nonwater-absorbing layer or drainage space.

2510.7 Preparation of masonry and concrete. Surfaces shall be clean, free from efflorescence, sufficiently damp and rough for proper bond. If the surface is insufficiently rough, approved bonding agents or a portland cement dash bond coat mixed in proportions of not more than two parts volume of sand to one part volume of portland cement or plastic cement shall be applied. The dash bond coat shall be left undisturbed and shall be moist cured not less than 24 hours.

2510.8 Fenestration. The juncture of exterior plaster and fenestration products shall be sealed with a sealant complying with AAMA 800 and ASTM C 920 Class 25 Grade NS or greater for proper joint expansion and contraction, ASTM C 1281, AAMA 812, or other approved standard as appropriate for the type of sealant.

SECTION 2511
INTERIOR PLASTER

2511.1 General. Plastering gypsum plaster or cement plaster shall not be less than three coats where applied over metal lath or wire fabric lath and not less than two coats where applied over other bases permitted by this chapter.

Exception: Gypsum veneer plaster and cement plaster specifically designed and approved for one-coat applications.

2511.1.1 Installation. Installation of lathing and plaster materials shall conform with Table 2511.1.1 and Section 2507.

TABLE 2511.1.1
INSTALLATION OF PLASTER CONSTRUCTION

MATERIAL	STANDARD
Gypsum plaster	ASTM C 842
Gypsum veneer plaster	ASTM C 843
Interior lathing and furring (gypsum plaster)	ASTM C 841
Lathing and furring (cement plaster)	ASTM C 1063
Portland cement plaster	ASTM C 926
Steel framing	ASTM C 754; C 1007

2511.2 Limitations. Plaster shall not be applied directly to fiber insulation board. Cement plaster shall not be applied directly to gypsum lath or gypsum plaster except as specified in Sections 2510.5.1 and 2510.5.2.

2511.3 Grounds. Where installed, grounds shall ensure the minimum thickness of plaster as set forth in ASTM C 842 and ASTM C 926. Plaster thickness shall be measured from the face of lath and other bases.

2511.4 Interior masonry or concrete. Condition of surfaces shall be as specified in Section 2510.7. Approved specially prepared gypsum plaster designed for application to concrete surfaces or approved acoustical plaster is permitted. The total thickness of base coat plaster applied to concrete ceilings shall be as set forth in ASTM C 842 or ASTM C 926. Should ceiling surfaces require more than the maximum thickness permitted in ASTM C 842 or ASTM C 926, metal lath or wire fabric lath shall be installed on such surfaces before plastering.

2511.5 Wet areas. Showers and public toilet walls shall conform to Sections 1210.2 and 1210.3. When wood frame walls and partitions are covered on the interior with cement plaster or tile of similar material and are subject to water splash, the framing shall be protected with an approved moisture barrier.

SECTION 2512
EXTERIOR PLASTER

2512.1 General. Plastering with cement plaster shall not be less than three coats where applied over metal lath or wire fabric lath and not less than two coats where applied over masonry, concrete or gypsum board backing as specified in Section 2510.5. If the plaster surface is to be completely covered by veneer or other facing material, or is completely concealed by another wall, plaster application need be only two coats, provided the total thickness is as set forth in ASTM C 926.

2512.1.1 On-grade floor slab. On wood framed or steel stud construction with an on-grade concrete floor slab system, exterior plaster shall be applied in such a manner as to cover, but not to extend below, the lath and paper. The application of lath, paper and flashing or drip screeds shall comply with ASTM C 1063.

2512.1.2 Weep screeds. A minimum 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed with a minimum vertical attachment flange of $3^1/_2$ inches (89 mm) shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C 926. The weep screed shall be placed a minimum of 4 inches (102 mm) above the earth or 2 inches (51 mm) above paved areas and be of a type that will allow trapped water to drain to the exterior of the building. The water-resistive barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.

2512.2 Plasticity agents. Only approved plasticity agents and approved amounts thereof shall be added to portland cement. When plastic cement or masonry cement is used, no additional lime or plasticizers shall be added. Hydrated lime or the equivalent amount of lime putty used as a plasticizer is permitted to be added to cement plaster or cement and lime plaster in an amount not to exceed that set forth in ASTM C 926.

2512.3 Limitations. Gypsum plaster shall not be used on exterior surfaces.

2512.4 Cement plaster. Plaster coats shall be protected from freezing for a period of not less than 24 hours after set has occurred. Plaster shall be applied when the ambient temperature is higher than 40°F (4°C), unless provisions are made to keep cement plaster work above 40°F (4°C) during application and 48 hours thereafter.

2512.5 Second-coat application. The second coat shall be brought out to proper thickness, rodded and floated sufficiently rough to provide adequate bond for the finish coat. The second coat shall have no variation greater than $^1/_4$ inch (6.4 mm) in any direction under a 5-foot (1524 mm) straight edge.

2512.6 Curing and interval. First and second coats of cement plaster shall be applied and moist cured as set forth in ASTM C 926 and Table 2512.6.

TABLE 2512.6
CEMENT PLASTERS[a]

COAT	MINIMUM PERIOD MOIST CURING	MINIMUM INTERVAL BETWEEN COATS
First	48 hours[a]	48 hours[b]
Second	48 hours	7 days[c]
Finish	—	Note c

a. The first two coats shall be as required for the first coats of exterior plaster, except that the moist-curing time period between the first and second coats shall not be less than 24 hours. Moist curing shall not be required where job and weather conditions are favorable to the retention of moisture in the cement plaster for the required time period.

b. Twenty-four-hour minimum interval between coats of interior cement plaster. For alternate method of application, see Section 2512.8.

c. Finish coat plaster is permitted to be applied to interior portland cement base coats after a 48-hour period.

2512.7 Application to solid backings. Where applied over gypsum backing as specified in Section 2510.5 or directly to unit masonry surfaces, the second coat is permitted to be applied as soon as the first coat has attained sufficient hardness.

2512.8 Alternate method of application. The second coat is permitted to be applied as soon as the first coat has attained sufficiently rigidity to receive the second coat.

2512.8.1 Admixtures. When using this method of application, calcium aluminate cement up to 15 percent of the weight of the portland cement is permitted to be added to the mix.

2512.8.2 Curing. Curing of the first coat is permitted to be omitted and the second coat shall be cured as set forth in ASTM C 926 and Table 2512.6.

2512.9 Finish coats. Cement plaster finish coats shall be applied over base coats that have been in place for the time periods set forth in ASTM C 926. The third or finish coat shall be applied with sufficient material and pressure to bond and to cover the brown coat and shall be of sufficient thickness to conceal the brown coat.

SECTION 2513
EXPOSED AGGREGATE PLASTER

2513.1 General. Exposed natural or integrally colored aggregate is permitted to be partially embedded in a natural or col-

ored bedding coat of cement plaster or gypsum plaster, subject to the provisions of this section.

2513.2 Aggregate. The aggregate shall be applied manually or mechanically and shall consist of marble chips, pebbles or similar durable, moderately hard (three or more on the Mohs hardness scale), nonreactive materials.

2513.3 Bedding coat proportions. The bedding coat for interior or exterior surfaces shall be composed of one-part portland cement, one-part Type S lime and a maximum of three parts of graded white or natural sand by volume. The bedding coat for interior surfaces shall be composed of 100 pounds (45.4 kg) of neat gypsum plaster and a maximum of 200 pounds (90.8 kg) of graded white sand. A factory-prepared bedding coat for interior or exterior use is permitted. The bedding coat for exterior surfaces shall have a minimum compressive strength of 1,000 pounds per square inch (psi) (6895 kPa).

2513.4 Application. The bedding coat is permitted to be applied directly over the first (scratch) coat of plaster, provided the ultimate overall thickness is a minimum of $^{7}/_{8}$ inch (22 mm), including lath. Over concrete or masonry surfaces, the overall thickness shall be a minimum of $^{1}/_{2}$ inch (12.7 mm).

2513.5 Bases. Exposed aggregate plaster is permitted to be applied over concrete, masonry, cement plaster base coats or gypsum plaster base coats installed in accordance with Section 2511 or 2512.

2513.6 Preparation of masonry and concrete. Masonry and concrete surfaces shall be prepared in accordance with the provisions of Section 2510.7.

2513.7 Curing of base coats. Cement plaster base coats shall be cured in accordance with ASTM C 926. Cement plaster bedding coats shall retain sufficient moisture for hydration (hardening) for 24 hours minimum or, where necessary, shall be kept damp for 24 hours by light water spraying.

SECTION 2514
HIGH-VELOCITY HURRICANE ZONES — LATHING

2514.1 General. Lath shall be gypsum, metal or wire lath, as set forth herein, and shall conform to the *Standard Specification for Interior Lathing and Furring*, ANSI A42.4.

2514.2 Gypsum lath. Gypsum lath shall conform to the *Standard Specification for Gypsum Lath*, ASTM C37.

2514.2.1 Gypsum lath shall be nailed to wood supports, at intervals not to exceed 5 inches (127 mm), with 13-gauge galvanized or blued nails having $^{19}/_{64}$-inch (7.5 mm) diameter flat heads (7.5 mm). Nails shall be not less than $1^{1}/_{8}$-inches (29 mm) long for $^{3}/_{8}$-inch(9.5 mm) lath nor less than $1^{1}/_{4}$-inches (32 mm) for $^{1}/_{2}$-inch (12.7 mm) lath. Each 16-inch (406 mm) width of lath shall be secured to each support with not less than five nails except that where fire-resistive-rated construction is not required, there shall not be less than four nails.

2514.2.2 Lath shall be secured to horizontal or vertical metal supports by means of approved special clips.

2514.2.3 The center-to-center spacing of wood supports shall not exceed 16 inches (406 mm) for $^{3}/_{8}$-inch (9.5 mm) gypsum lath and shall not exceed 24 inches (610 mm) for $^{1}/_{2}$-inch (12.7 mm) gypsum lath.

2514.2.4 The center-to-center spacing for gypsum lath applied to metal studs shall not exceed that set forth herein above for wood supports except that $^{3}/_{8}$-inch (9.5 mm) gypsum lath may be applied to metal studs spaced 24 inches (610 mm) on centers where a minimum of $^{3}/_{4}$-inch (19 mm), three-coat plaster is applied over the lath.

2514.2.5 Lath shall be applied with face side out and with the long dimension at right angles to the framing members. Joints shall be broken in each course, except that end joints may fall on one support when such joints are covered with 3 inch (76 mm) wide strips of metal lath. Lath shall be butted together.

2514.2.6 Corner bead and inside angle reinforcing shall not be required.

2514.2.7 No interior lath shall be applied until the roof is on and the building is dried in.

2514.3 Metal and wire lath.

2514.3.1 Metal and wire lath and metal accessories embedded in the plaster shall be galvanized or otherwise rust-resistant by approved means. Weight tags shall be left on all metal or wire lath until approved by the building official.

2514.3.2 The weight of metal and wire lath and the spacing of supports shall conform to the requirements set forth in Table 2514.3.2.

2514.3.3 All metal lath shall be lapped 1 inch (25 mm) minimum.

2514.3.4 All attachments for securing metal lath, wire lath and wire fabric to supports shall be spaced not more than 6 inches (152 mm) apart, and side laps shall be secured to supports and be tied between supports at not to exceed 9 inches (229 mm) intervals.

2514.3.5 Metal and wire lath shall be attached to vertical wood supports with the equivalent of 4d galvanized or blue common nails driven to a penetration of at least $^{3}/_{4}$ inch (19 mm) and bent over to engage not less than three strands of lath. Metal and wire lath shall be attached to ceiling joists or other horizontal wood supports with the equivalent of No. 11-gauge, barbed, galvanized or blued nails $1^{1}/_{2}$ inches (38 mm) long having a head not less than $^{3}/_{8}$ inch (9.5 mm) in diameter.

2514.3.6 Metal and wire lath shall be attached to horizontal and vertical metal supports with the equivalent of No. 8 galvanized sheet-metal screws.

2514.4 Nonbearing lath and plaster partitions.

2514.4.1 Where reinforced plaster or pneumatically placed plaster partitions are used, they shall have vertical steel or iron channels with a depth of not less than one-third of the thickness of the partition and spaced not more than 24 inches (610 mm) on centers. The thickness of metal in the channels shall not be less than 16 U.S. standard gauge or light gauge steel studs.

TABLE 2514.3.2
WEIGHTS OF METAL AND WIRE LATH(*)

TYPE OF LATH	MINIMUM WGT (lb per sq yd)	MAXIMUM SPACING OF SUPPORTS (in.)	
		For Walls	For Ceilings
Flat Expanded Metal Lath	2.5	16	0
Flat Expanded Metal Lath	3.4	16	16
Flat Rib Metal Lath	2.75	16	12
Flat Rib Metal Lath	3.4	19	19
$^3/_8$" Rib Metal Lath	3.4	24	24
Sheet-Metal Lath	4.5	24	24
Wire Lath	2.48	16	12
Wire Fabric	**	16	16

For SI: 1 inch = 25.4 mm, 1 square yard = 0.8361 m^2.

* V-stiffened that expanded metal lath of equal rigidity and weight is permissible on the same spacings as $^3/_8$-inch rib metal lath.

** Paper-backed wire fabric, No. 16-gauge wire, 2-inch by 2-inch mesh, with stiffener.

2514.4.2 Hollow nonbearing partitions of reinforced plaster or pneumatically placed plaster shall have a shell thickness of not less than $^3/_4$ inch (19 mm).

2514.4.3 Metal reinforcing shall be as set forth in Table 2514.3.2, and gypsum lath shall not be less than $^3/_8$ inch (9.5 mm) in thickness. The minimum thickness of metal lath and plaster partitions shall be not less than 2 inches (51 mm) or $^1/_{84}$ of the distance between supports.

2514.5 Suspended and furred plaster ceilings.

2514.5.1 General. Suspended or furred plaster ceilings shall be designed and constructed as set forth herein.

2514.5.2 Main runners. Main runners or carriers shall be rolled steel channels not less than the sizes and weights set forth in Table 2514.5.2.

A main runner shall be located not more than 6 inches (152 mm) from parallel walls to support the ends of cross furring. The ends of main runners at walls shall be supported by hangers located not more than 12 inches (305 mm) from such ends. Splices in main runners shall be lapped 12 inches (305 mm) and tied, each end, with double loops of No. 16-gauge wire.

2514.5.3 Cross furring. Cross furring, or spacers, for various spacing of main runners or other supports shall be not less than as set forth in Table 2514.5.3.

2514.5.3.1 Cross furring shall be securely saddle-tied to the main runners by not less than two strands of No. 16 W and M gauge galvanized wire or equivalent approved attachments. Cross furring shall be attached to joists or beams with double No. 14 W and M gauge galvanized wire or equivalent approved attachments.

Splices in cross furring shall be lapped 8 inches (203 mm) and tied, each end, with double loops of No. 16-gauge wire.

2514.5.4 Hangers. Hangers supporting suspended ceilings shall be not less than as set forth in Table 2514.5.4.

TABLE 2514.5.2
SPANS AND SPACING OF MAIN RUNNERS

MINIMUM SIZE AND TYPE (inches)	MAXIMUM SPAN BETWEEN HANGERS OR SUPPORTS (feet, inches)	MAXIMUM CENTER-TO-CENTER SPACING OF RUNNERS (feet, inches)
$^3/_4$ - 0.3 lb per ft	2-0	3-0
1-$^1/_2$ - 0.475 lb per ft	3-0	4-0
1-$^1/_2$ - 0.475 lb per ft	3-6	3-6
1-$^1/_2$ - 0.475 lb per ft	4-0	3-0
1-$^1/_2$ - 1.12 lb per ft	4-0	5-0
2 -1.26 lb per ft	5-0	5-0
1-$^1/_2$ x 1-$^1/_2${*} by $^3/_{16}$ angle	5-0	5-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb/ft = 1.4882 kg/m.

TABLE 2514.5.3
SIZES OF CROSS FURRING IN SUSPENDED AND FURRED CEILINGS

SIZE AND TYPE (inches)	MAXIMUM SPAN BETWEEN SUPPORTS (feet)	MAXIMUM SPACING (inches)
1/4 pencil rods	Up to 2-0	12
3/4 channels	Up to 3-0	24
3/4 channels	Up to 4-0	16

For SI: 1 inch = 25.4 mm.

TABLE 2514.5.4
HANGERS SUPPORTING SUSPENDED CEILINGS

CEILING AREA SUPPORTED (SQUARE FEET)	MINIMUM SIZE OF HANGER
12.5	8-gauge wire
16	6-gauge wire
18	3/16" rod
22.5	1/4" rod
50	1" x 3/16" flat bar

For SI: 1 inch = 25.4 mm.

2514.5.4.1 Hangers shall be saddle-tied or wrapped around main runners to develop the full strength of the hangers. Hangers shall be fastened to or embedded in the structural framing, masonry or concrete. Lower ends of flat-strap hangers shall be bolted with 3/8 inch (9.5 mm) bolts to runner channels or bent tightly around corners and bolted to the main part of the hanger. Where the area of a plastered ceiling exceeds 100 square feet (93 m^2), suitable methods to resist uplift forces shall be provided for each 64 square feet (6 m^2) of ceiling.

SECTION 2515
HIGH-VELOCITY HURRICANE ZONES — PLASTER

2515.1 General.

2515.1.1 Gypsum plastering shall conform to the *Standard Specification for Gypsum Plastering*, ANSI A42.1.

2515.1.2 Plastering with gypsum, hardwall, lime or cement plaster shall be three-coat work when applied over metal and wire lath and shall be not less than two-coat work when applied over gypsum lath or gypsum block.

2515.1.3 Portland cement plaster shall not be applied directly to gypsum lath.

2515.1.4 In no case shall a brush coat be accepted as a required coat where three-coat work is required by this section.

2515.1.5 Grounds shall be installed to provide for the thickness of plaster, as set forth in Table 2515.1.5, as measured from the face of the lath.

TABLE 2515.1.5
REQUIRED THICKNESS OF INTERIOR PLASTER

TYPE OF LATH	THICKNESS OF PLASTER (inches)
Metal or wire lath	5/8 minimum
Gypsum lath	1/2 minimum

For SI: 1 inch = 25.4 mm.

2515.1.6 If monolithic-concrete ceiling surfaces require more than 3/8 inch (9.5 mm) of plaster to produce desired lines or surfaces, metal lath or wire lath shall be attached thereto; except that special bonding agents approved by the building official may be used.

2515.1.7 The building official may require test holes to be made for the purpose of determining the thickness of plaster.

2515.2 Materials.

2515.2.1 Aggregates.

2515.2.1.1 Inorganic aggregates used for plaster and stucco shall conform to the *Standard Specification for Inorganic Aggregates for Use In Gypsum Plaster*, ASTM C 35, except that graduation of locally produced sand shall be such that the fineness modulus is between 1.20 and 2.35.

2515.2.1.2 Aggregates shall be quarried or washed in fresh water and shall contain not more than 1/20 of one percent salt, by weight.

2515.2.2 Gypsum. Gypsum plaster shall conform to the *Standard Specification for Gypsum Plaster*, ASTM C 28.

2515.2.3 Lime. Lime shall conform to the *Standard Specification for Quicklime for Structural Purposes*, ASTM C 5, and the *Standard Specification for Special Finish Hydrated Lime*, ASTM C 206.

2515.2.4 Keene's cement. Keene's cement shall conform to the *Standard Specification for Keene's Cement*, ASTM C 61.

2515.2.5 Portland cement.

2515.2.5.1 Portland cement shall conform to the *Standard Specification for Portland Cement*, ASTM C 150.

2515.2.5.2 Approved types of plasticity agents may be added to cement in the manufacturing process or when mixing the plaster, but in no case shall the amount of the

TABLE 2515.3.1.1
GYPSUM AND HARDWALL PLASTER

APPLICATION METHOD	DAMP LOOSE SAND (LB)	VERMICULITE OR PERLITE (CU FT)
TWO-COAT WORK (DOUBLE-UP METHOD)		
(1) Over gypsum lath	250	2-1/2
(2) Over masonry[2]	300	3
THREE-COAT WORK		
(1) First (scratch) coat over lath	200[1]	2
(2) First (scratch) coat over masonry	300	3
(3) All second (brown) coats	300[1]	3

For SI: 1 cubic foot = 0.02832 m^3, 1 pound = 0.454 kg.

1. Except over monolithic concrete.
2. In lieu of the proportioning specified, the proportions may be 100 pounds of gypsum neat plaster to not more than 250 pounds of damp, loose sand or $2^1/_2$ cubic feet of vermiculite or perlite, provided this proportioning is used for both scratch and brown coats.

plasticity agent exceed 10 percent of the volume of cement in the plaster mixture.

2515.2.6 Masonry cement. Masonry cement shall be Type II and shall conform to the *Standard Specification for Masonry Cement*, ASTM C 91.

2515.3 Proportioning and mixing.

2515.3.1 Base coats. The proportions of sand, vermiculite or perlite to 100 pounds (45.4 kg) of gypsum neat plaster shall not exceed the requirements in this section.

2515.3.1.1 Gypsum or hardwall plaster. Gypsum or hardwall plaster shall be proportioned in accordance with Section 2515.3.1.1.

2515.3.1.2 Wood-fiber gypsum plaster. Wood-fiber gypsum plaster for use on all types of lath shall be mixed with water only and shall be mixed in the proportion of one part of plaster to one part of sand, by weight, for use on masonry.

2515.3.1.3 Ready mixed plaster. Gypsum ready-mixed plaster shall be in the proportion of 100 pounds (45.4 kg) of gypsum neat plaster to not more than 250 pounds (113 kg) of sand; or when vermiculite or perlite is used as an aggregate, the proportions shall be 100 pounds (45.4 kg) of gypsum neat plaster to not more than $2^1/_2$ cubic feet (0.07 m^3) vermiculite or perlite.

2515.3.1.4 Portland cement plaster. For three-coat work, the first two coats shall be required for the first two coats of exterior stucco (see Section 2516).

2515.3.1.5 Masonry cement plaster. For two- or three-coat work, all work shall be set forth in Section 2515.

2515.3.2 Finish coats for gypsum or lime plaster. The finish coats shall be mixed and proportioned in accordance with this section.

2515.3.2.1 Smooth white finish, mixed in the proportion of not less than one part gypsum gaging plaster to three parts lime putty, by volume, or an approved prepared gypsum trowel finish.

2515.3.2.2 Sand-float finish, mixed in the proportion of one-half part of Keene's cement to two parts of lime putty and not more than four and one-half parts of sand, by volume, or an approved gypsum sand-float finish.

2515.3.2.3 Keene's cement finish, mixed in the proportion of three parts Keene's cement to one part lime putty, by volume.

2515.3.2.4 Lime sand-float finish, mixed in the proportion of three parts lime putty to three parts sand, by volume.

2515.3.2.5 Finish coat for perlite or vermiculite aggregate plasters, mixed in the proportion of 1 cubic foot (28 339 cc) of aggregate to 100 pound (45 kg) of unfibered gypsum plaster, or mixed according to manufacturer's specifications.

2515.3.3 Finish coat for Portland cement plaster. Finish coats for interior Portland cement plaster shall be one of the following:

1. As required for the third coat of exterior stucco. See Section 2413.
2. A gaged cement plaster mixed in proportion of one part Portland cement to not more than 15 percent lime putty and not more than four parts of sand, by volume.

2515.3.4 Finish coat for masonry cement plaster. Finish coat for masonry cement plaster shall be as set forth in Section 2515.4.2.3.

2515.4 Application.

2515.4.1 Base coats.

2515.4.1.1 Gypsum plaster. The scratch coat shall be applied with sufficient material and pressure to form a full key or bond.

2515.4.1.1.1 For two-coat work it shall be doubled back to bring the plaster out to grounds and straightened to a true surface and left rough to receive the finish coat.

2515.4.1.1.2 For three-coat work, the scratch (first) coat shall be scratched to a rough surface. The brown (second) coat shall be applied after the scratch coat

has set firm and hard, brought out to grounds, straightened to a true surface with rod and darby and left rough, ready to receive the finish (third) coat.

2515.4.1.1.3 The finish coat shall be applied to a practically dry base coat or to a thoroughly dry base coat which has been evenly wetted by brushing or spraying. The use of excessive water shall be avoided in the application of all types of finish coat plastering.

2515.4.1.2 Portland cement plaster. The first two coats shall be as required for the first two coats of exterior stucco, except that the interval between the first and second coats shall be not less than 24 hours.

2515.4.1.3 Masonry cement plaster. Where masonry cement is the only cementitious material, the second coat may be applied to the base coat as soon as the base coat has attained sufficient strength and rigidity to support the second (finish) coat.

2515.4.2 Finish.

2515.4.2.1 Smooth white finish shall be applied over the base coat that has set for a period of not less than 24 hours and is surface dry. Thickness shall be from $^1/_{16}$ inch to $^1/_8$ inch (1.6 mm to 3.3 mm).

2515.4.2.2 Sand-float finish shall be applied over the set base coat that is not quite dry.

2515.4.2.3 Keene's cement finish shall be applied over the set base coat that is not quite dry. Thickness shall be from $^1/_{16}$ inch to $^1/_8$ inch (1.6 to 3.3 mm), unless finish coat is marked off or is jointed; in which case, the thickness may be increased as required by depth of marking or jointing.

2515.4.2.4 The finish coat for interior Portland cement plastering shall be applied in the same manner as required for the third coat of exterior stucco, except that other types of finish coat may be applied as specified in Section 2413.

2515.4.2.5 The finish coat for lightweight aggregate plastering shall be from $^1/_{16}$ inch to $^1/_8$ inch (1.6 mm to 3.3 mm).

2515.4.3 Plaster on concrete.

2515.4.3.1 Monolithic concrete surfaces shall be clean, free from efflorescence, damp and sufficiently rough to insure adequate bond.

2515.4.3.2 Gypsum plaster applied to monolithic-concrete ceilings shall be specially prepared bond plaster for use on concrete, to which only water shall be added. Gypsum plaster on monolithic walls and columns shall be applied over a scratch coat of bond plaster, or other bonding material, before it has set. The brown coat shall be brought out to grounds, straightened to a true surface and left rough, ready to receive the finish coat.

2515.4.3.3 Portland cement plaster applied to interior concrete walls or ceilings shall conform to requirements for application to exterior concrete walls as specified in Section 2516.

SECTION 2516
HIGH-VELOCITY HURRICANE ZONES — STUCCO

2516.1 General.

2516.1.1 Portland cement-based plaster shall be applied in accordance with ASTM C 926, excluding Table 4 of that standard.

2516.1.2 Stucco base and finish coats, where required to meet fire-resistance requirements, shall be mixed in proportion of at least one part portland cement to a maximum of two and one-half parts sand by volume.

2516.1.3 Approved manufacturing products may be used for base and finish coats.

2516.1.4 Materials. The materials of stucco shall conform to ASTM C 926.

2516.1.5 Admixtures.

2516.1.5.1 Plasticity agents shall be of approved types and amounts and, where added to Portland cement in the manufacturing process, no additions shall be made later.

2516.1.5.2 Color may be added to the finish coat in approved amounts.

2516.1.6 Application.

2516.1.6.1 Stucco applied to concrete or masonry to meet fire-resistance requirements shall consist of at least two coats, and the total thickness shall be not less than $^1/_2$ inch (12.7 mm).

2516.1.6.2 Masonry surfaces on which all stucco is applied shall be clean, free from efflorescence, damp and sufficiently rough, or coated with an approved bonding agent, to insure proper bond.

2516.1.6.3 All concrete surfaces shall be coated with an approved bonding agent or shall be effectively roughened.

2516.1.6.4 The first coat shall be well forced into the pores of the masonry, shall be brought out to grounds, straightened to a true surface and left rough enough to receive the finish coat.

2516.1.6.5 The first coat shall be rodded and waterfloated to a true surface approximately one-half the total thickness.

2516.1.6.6 The base coat shall be damp cured for a period of not less than 24 hours.

2516.1.6.7 In lieu thereof, the finish coat, where containing appropriate waterproofing or curing admixtures, may be applied as soon as the base coat has attained initial set and is sufficiently firm to receive the finish coat.

2516.1.6.8 The finish coat shall be applied over a uniformly damp but surface-dry base.

2516.1.6.9 Stucco shall be kept damp for a period of not less than 48 hours after application of the finish coat.

2516.1.6.10 In lieu thereof, the finish coat may contain appropriate approved waterproofing or curing agents.

2516.2 Stucco on walls other than concrete or masonry.

2516.2.1 General. Stucco shall be as set forth in Section 2516.1.

2516.2.2 Moisture barrier. Wood shall be covered with 15-pound (7 kg) roofing felt, or other approved equally moisture-resisting layer, and metal reinforcement as set forth herein.

2516.2.3 Metal reinforcement.

2516.2.3.1 Stucco shall be reinforced with galvanized expanded metal weighing no less than 1.8 pounds per square yard (0.98 kg/m^2), or galvanized welded or woven wire-fabric weighing no less than 1 pound per square yard (0.54 kg/m^2).

2516.2.3.2 All metal lathing shall be lapped not less than 1 inch (25 mm).

2516.2.3.3 Metal reinforcement shall be furred out from the backing by an approved method.

2516.2.3.4 Fastenings into wood sheathing or wood framing shall be by galvanized nails, with heads not less than $^3/_8$ inch (9.5 mm) in diameter, driven to full penetration, using a minimum of two nails per square foot (0.093 m^2), or by approved staples having equal resistance to withdrawal.

2516.2.3.5 The fastening of rib-lath to metal members shall be by #8 galvanized sheet-metal screws, using a minimum of two screws per square foot (0.093 m^2).

2516.2.4 Application.

2516.2.4.1 Stucco applied on metal lath shall be three-coat work applied to a total thickness of not less than $^1/_2$ inch (12.7 mm) thickness except as required to meet fire-resistance requirements.

2516.2.4.2 The first coat shall be forced through all openings in the reinforcement to fill all spaces and scored horizontally.

2516.2.4.3 The second coat shall be applied after the first coat has set sufficiently to provide a rigid backing.

2516.2.4.4 The third coat shall be applied as soon as the second coat has attained initial set.

2516.3 Pneumatically placed stucco.

2516.3.1 Pneumatically-placed stucco shall consist of a mixture of one part Portland cement to not more than five parts sand, conveyed through a pipe or flexible tube and deposited by pressure in its final position.

2516.3.2 Rebound material may be screened and reused as sand in an amount not greater than 25 percent of the total sand in any batch.

2516.3.3 Plasticity agents may be used as specified in Section 2516.1.5.1.

SECTION 2517
HIGH-VELOCITY HURRICANE ZONES — GYPSUM BOARD PRODUCTS AND ACCESSORY ITEMS

2517.1 General.

2517.1.1 Gypsum wallboard products and related items and accessories to be used with or without the addition of plaster for partitions, walls and ceilings shall be as set forth in this section.

2517.1.2 Where required to be fire resistive, such assemblies shall also comply with Chapter 7 of this code.

2517.2 Standards. The following standards are adopted as set forth in Chapter 35.

Standard Specification for the Application and Finishing of Gypsum Wallboard, ANSI A97.1.

Specification for Gypsum Wallboard, ASTM C 36.

Specification for General Requirements for Zinc-Coated (Galvanized) Steel Sheets, by the Hot-Dip Process, ASTM A 525.

Specification for Light-gauge Steel Studs, Runners, and Rigid Furring Channels, ASTM C 645.

Specification for Joint Treatment Materials for Gypsum Wallboard Construction, ASTM C 475.

2517.3 Gypsum wallboard.

2517.3.1 The gypsum wallboard shall comply with the standards set forth in Section 2517.2, and single or multiple system combinations shall be not less than $^1/_2$ inch (12.7 mm) in thickness.

2517.3.2 The span between supports for gypsum wallboard shall be not more than 24 inches (610 mm) for $^1/_2$ inch (12.7 mm) thick and $^5/_8$ inch (17.1 mm) thick wallboard.

2517.3.3 Gypsum wallboard used in fire-rated assemblies shall be of a type for which test ratings are available.

2517.4 Wood studs and wood ceiling supports. Wood studs and wood ceiling supports shall comply with Chapter 23 (High-Velocity Hurricane Zones).

2517.5 Steel studs, ceiling supports and track runners.

2517.5.1 Steel studs and runners used to construct fire-resistive walls or partitions shall be hot-dipped galvanized in accordance with ASTM A 525, coating designation G40, minimum and be of channel or "C"-type shape. The total thickness of the base metal plus coating shall not be less than 0.0184 inch (0.467 mm) unpainted and not less than 0.0194 inch (0.493 mm) if coated and painted. Studs and runners shall comply with ASTM C 645 and have a base metal thickness, before application of any coating, of not less than 0.0179 inch (0.455 mm). Structural properties of such studs and runners shall comply with ASTM C 645.

2517.5.1.1 Steel studs supporting wall hung plumbing fixtures shall be doubled or not less than 20 gauge with a minimum effective moment of inertia equal to 0.864 $in.^4$ (360 m^4).

2517.5.1.2 Such studs shall be rigidly connected top and bottom to prevent significant end rotation or displacement.

2517.5.1.3 A horizontal member securely fastened to not less than two studs shall be installed for the attachment of each wall hung plumbing fixture.

2517.5.2 The unsupported height of partitions shall comply with the loads and deflections set forth in Chapter 16 (High-Velocity Hurricane Zones) and where wallboard is suitably attached, the composite action may be accounted for in the design.

2517.5.3 Steel ceiling supports shall comply with Section 2514.5.

2517.5.4 Steel studs track runners and ceiling supports in walls, including curtain walls, shall comply with ASTM A 525.

Exception: Such members in interior nonload-bearing walls need not be galvanized but shall comply with ASTM C 645.

2517.6 Attachments.

2517.6.1 Attachments shall be as set forth herein and for fire-rated assemblies shall also conform to the material and conditions of the assembly tested.

2517.6.2 Attachment to wood supporting members shall conform to the standard set forth in Section 2517.2.

2517.6.3 Nails and screws attaching gypsum wallboard shall, without substantially fracturing the surface paper, be driven below the surface and spotted with finishing joint compound.

2517.6.4 Attachment to metal members shall be in accordance with Section 2517.6.4.1 through Section 2517.6.4.5.

2517.6.4.1 Gypsum wallboard shall be attached to metal members by self-drilling, self-tapping sheet metal screws.

2517.6.4.2 The spacing of screws attaching gypsum wallboard to metal studs and runners, shall be not more than 12 inches (305 mm) on center.

2517.6.4.3 Screws for attaching gypsum wallboard to metal studs shall be not less than $^{7}/_{8}$ inch (22.2 mm) long for $^{1}/_{2}$ inch (17.7 mm) wallboard or 1 inch (25.4 mm) long for $^{5}/_{8}$ inch (17.1 mm) wallboard.

2517.6.4.4 Screws attaching gypsum wallboard shall be driven below the surface and spotted with finishing compound.

2517.6.4.5 Runners shall be fastened to the ceiling, contiguous walls and partitions and to the floor at intervals not exceeding 24 inches (610 mm) on center. Such attachment may be by nails penetrating the base material not less than $^{5}/_{8}$ inch (17.1 mm) or by self-drilling, self-tapping sheet metal screws attaching metal to metal.

SECTION 2518
HIGH-VELOCITY HURRICANE ZONES — SUSPENDED AND FURRED CEILINGS

2518.1 General. Lath and plaster ceilings shall be as set forth in this chapter.

2518.2 Suspended and furred ceilings, other than lath and plaster where providing fire protection shall comply with Chapter 7.

2518.3 Suspended and furred ceilings, other than lath and plaster, shall be suspended and supported in conformance with the conditions of fire tests or, if not tested, as recommended by the manufacturer or as required for structural stability.

SECTION 2519
HIGH-VELOCITY HURRICANE ZONES — ASBESTOS

2519.1 Asbestos cement shall not be permitted for use under this code.

SECTION 2520
HIGH-VELOCITY HURRICANE ZONES — TILE

2520.1 Ceramic and Portland cement floor tile shall be set on a concrete slab or on wood sheathing on wood joists protected by a waterproof membrane.

2520.2 Floor tile shall be set in a mortar bed of one part portland cement to three parts aggregate or otherwise bedded in an approved adhesive material.

2520.2.1 Ceramic and portland cement wall tile used in areas subject to frequent wearing shall be backed with masonry, stucco on wire lath or approved tile backer board.

2520.2.2 Wall tile used in areas not subject to frequent wearing shall be backed by a cladding having the rigidity of stucco on wire lath and shall be bedded in cement mortar or other approved adhesive material.

2520.3 Portland cement or other porous tile shall be soaked in water not less than 1 hour before placing.

2520.4 Built-in tubs with overhead showers shall have waterproof joints between the tub and the wall and floor.

CHAPTER 26
PLASTIC

SECTION 2601
GENERAL

2601.1 Scope. These provisions shall govern the materials, design, application, construction and installation of foam plastic, foam plastic insulation, plastic veneer, interior plastic finish and trim and light-transmitting plastics. See Chapter 14 for requirements for exterior wall finish and trim.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 2603.9 and 2612.

SECTION 2602
DEFINITIONS

2602.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustical purposes and that has a density less than 20 pounds per cubic foot (pcf) (320 kg/m^3).

LIGHT-DIFFUSING SYSTEM. Construction consisting in whole or in part of lenses, panels, grids or baffles made with light-transmitting plastics positioned below independently mounted electrical light sources, skylights or light-transmitting plastic roof panels. Lenses, panels, grids and baffles that are part of an electrical fixture shall not be considered as a light-diffusing system.

LIGHT-TRANSMITTING PLASTIC ROOF PANELS. Structural plastic panels other than skylights that are fastened to structural members, or panels or sheathing and that are used as light-transmitting media in the plane of the roof.

LIGHT-TRANSMITTING PLASTIC WALL PANELS. Plastic materials that are fastened to structural members, or to structural panels or sheathing, and that are used as light-transmitting media in exterior walls.

PLASTIC, APPROVED. Any thermoplastic, thermosetting or reinforced thermosetting plastic material that conforms to combustibility classifications specified in the section applicable to the application and plastic type.

PLASTIC GLAZING. Plastic materials that are glazed or set in frame or sash and not held by mechanical fasteners that pass through the glazing material.

REINFORCED PLASTIC, GLASS FIBER. Plastic reinforced with glass fiber having not less than 20 percent of glass fibers by weight.

THERMOPLASTIC MATERIAL. A plastic material that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

THERMOSETTING MATERIAL. A plastic material that is capable of being changed into a substantially nonreformable product when cured.

SECTION 2603
FOAM PLASTIC INSULATION

2603.1 General. The provisions of this section shall govern the requirements and uses of foam plastic insulation in buildings and structures.

2603.2 Labeling and identification. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, the product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

2603.3 Surface-burning characteristics. Unless otherwise indicated in this section, foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E 84. Loose fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

Exceptions:

1. Smoke-developed index for interior trim as provided for in Section 2604.2.
2. In cold storage buildings, ice plants, food plants, food processing rooms and similar areas, foam plastic insulation where tested in a thickness of 4 inches (102 mm) shall be permitted in a thickness up to 10 inches (254 mm) where the building is equipped throughout with an automatic fire sprinkler system in accordance with Section 903.3.1.1. The approved automatic sprinkler system shall be provided in both the room and that part of the building in which the room is located.
3. Foam plastic insulation that is a part of a Class A, B or C roof-covering assembly provided the assembly with the foam plastic insulation satisfactorily passes FM 4450 or UL 1256. The smoke-developed index shall not be limited for roof applications.
4. Foam plastic insulation greater than 4 inches (102 mm) in thickness shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided the end use is approved in accordance with Section 2603.9 using the thickness and density intended for use.

5. Flame spread and smoke-developed indexes for foam plastic interior signs in covered mall buildings provided the signs comply with Section 402.15.

2603.4 Thermal barrier. Except as provided for in Sections 2603.4.1 and 2603.9, foam plastic shall be separated from the interior of a building by an approved thermal barrier of 0.5-inch (12.7 mm) gypsum wallboard or equivalent thermal barrier material that will limit the average temperature rise of the unexposed surface to not more than 250°F (120°C) after 15 minutes of fire exposure, complying with the standard time-temperature curve of ASTM E 119. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on FM 4880, UL 1040, NFPA 286 or UL 1715. Combustible concealed spaces shall comply with Section 717.

2603.4.1 Thermal barrier not required. The thermal barrier specified in Section 2603.4 is not required under the conditions set forth in Sections 2603.4.1.1 through 2603.4.1.13.

2603.4.1.1 Masonry or concrete construction. A thermal barrier is not required for foam plastic installed in a masonry or concrete wall, floor or roof system where the foam plastic insulation is covered on each face by a minimum of 1 inch (25 mm) thickness of masonry or concrete.

2603.4.1.2 Cooler and freezer walls. Foam plastic installed in a maximum thickness of 10 inches (254 mm) in cooler and freezer walls shall:

1. Have a flame spread index of 25 or less and a smoke-developed index of not more than 450, where tested in a minimum 4 inch (102 mm) thickness.
2. Have flash ignition and self-ignition temperatures of not less than 600°F and 800°F (316°C and 427°C), respectively.
3. Have a covering of not less than 0.032-inch (0.8 mm) aluminum or corrosion-resistant steel having a base metal thickness not less than 0.0160 inch (0.4 mm) at any point.
4. Be protected by an automatic sprinkler system. Where the cooler or freezer is within a building, both the cooler or freezer and that part of the building in which it is located shall be sprinklered.

2603.4.1.3 Walk-in coolers. In nonsprinklered buildings, foam plastic having a thickness that does not exceed 4 inches (102 mm) and a maximum flame spread index of 75 is permitted in walk-in coolers or freezer units where the aggregate floor area does not exceed 400 square feet (37 m^2) and the foam plastic is covered by a metal facing not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm). A thickness of up to 10 inches (254 mm) is permitted where protected by a thermal barrier.

2603.4.1.4 Exterior walls—one-story buildings. For one-story buildings, foam plastic having a flame spread index of 25 or less, and a smoke-developed index of not more than 450, shall be permitted without thermal barriers in or on exterior walls in a thickness not more than 4 inches (102 mm) where the foam plastic is covered by a thickness of not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a base metal thickness of 0.0160 inch (0.41 mm) and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2603.4.1.5 Roofing. Foam plastic insulation under a roof assembly or roof covering that is installed in accordance with the code and the manufacturer's instructions shall be separated from the interior of the building by wood structural panel sheathing not less than 0.47 inch (11.9 mm) in thickness bonded with exterior glue, with edges supported by blocking, tongue-and-groove joints or other approved type of edge support, or an equivalent material. A thermal barrier is not required for foam plastic insulation that is a part of a Class A, B or C roof-covering assembly, provided the assembly with the foam plastic insulation satisfactorily passes FM 4450 or UL 1256.

2603.4.1.6 Attics and crawl spaces. Within an attic or crawl space where entry is made only for service of utilities, foam plastic insulation shall be protected against ignition by 1.5-inch-thick (38 mm) mineral fiber insulation; 0.25-inch-thick (6.4 mm) wood structural panel, particleboard or hardboard; 0.375-inch (9.5 mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4 mm) or other approved material installed in such a manner that the foam plastic insulation is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

2603.4.1.7 Doors not required to have a fire protection rating. Where pivoted or side-hinged doors are permitted without a fire protection rating, foam plastic insulation, having a flame spread index of 75 or less and a smoke-developed index of not more than 450, shall be permitted as a core material where the door facing is of metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or steel having a base metal thickness of not less than 0.016 inch (0.4 mm) at any point.

2603.4.1.8 Exterior doors in buildings of Group R-2 or R-3. In occupancies classified as Group R-2 or R-3, foam-filled exterior entrance doors to individual dwelling units that do not require a fire-resistance rating shall be faced with wood or other approved materials.

2603.4.1.9 Garage doors. Where garage doors are permitted without a fire-resistance rating and foam plastic is used as a core material, the door facing shall be metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or 0.010-inch (0.25 mm) steel or the facing shall be minimum 0.125-inch-thick (3.2 mm) wood. Garage doors having facings other than those described above shall be tested in accordance with, and meet the acceptance criteria of, DASMA 107.

Exception: Garage doors using foam plastic insulation complying with Section 2603.3 in detached and attached garages associated with one- and two-family dwellings need not be provided with a thermal barrier.

2603.4.1.10 Siding backer board. Foam plastic insulation of not more than 2,000 British thermal units per square feet (Btu/sq. ft.) (22.7 MJ/m^2) as determined by NFPA 259 shall be permitted as a siding backer board with a maximum thickness of 0.5 inch (12.7 mm), provided it is separated from the interior of the building by not less than 2 inches (51 mm) of mineral fiber insulation or equivalent or where applied as insulation with re-siding over existing wall construction.

2603.4.1.11 Interior trim. Foam plastic used as interior trim in accordance with Section 2604 shall be permitted without a thermal barrier.

2603.4.1.12 Interior signs. Foam plastic used for interior signs in covered mall buildings in accordance with Section 402.15 shall be permitted without a thermal barrier. Foam plastic signs that are not affixed to interior building surfaces shall comply with the *Florida Fire Prevention Code*.

2603.4.1.13 Type V construction. Foam plastic spray applied to a sill plate and header of Type V construction is subject to all of the following:

1. The maximum thickness of the foam plastic shall be $3^1/_4$ inches (82.6 mm).
2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m^3).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E 84.

2603.5 Exterior walls of buildings of any height. Exterior walls of buildings of Type I, II, III or IV construction of any height shall comply with Sections 2603.5.1 through 2603.5.7. Exterior walls of cold storage buildings required to be constructed of noncombustible materials, where the building is more than one story in height, shall also comply with the provisions of Sections 2603.5.1 through 2603.5.7. Exterior walls of buildings of Type V construction shall comply with Sections 2603.2, 2603.3 and 2603.4.

2603.5.1 Fire-resistance-rated walls. Where the wall is required to have a fire-resistance rating, data based on tests conducted in accordance with ASTM E 119 shall be provided to substantiate that the fire-resistance rating is maintained.

2603.5.2 Thermal barrier. Any foam plastic insulation shall be separated from the building interior by a thermal barrier meeting the provisions of Section 2603.4, unless special approval is obtained on the basis of Section 2603.9.

Exception: One-story buildings complying with Section 2603.4.1.4.

2603.5.3 Potential heat. The potential heat of foam plastic insulation in any portion of the wall or panel shall not exceed the potential heat expressed in Btu per square feet (MJ/m^2) of the foam plastic insulation contained in the wall assembly tested in accordance with Section 2603.5.5. The potential heat of the foam plastic insulation shall be determined by tests conducted in accordance with NFPA 259 and the results shall be expressed in Btu per square feet (MJ/m^2).

Exception: One-story buildings complying with Section 2603.4.1.4.

2603.5.4 Flame spread and smoke-developed indexes. Foam plastic insulation, exterior coatings and facings shall be tested separately in the thickness intended for use, but not to exceed 4 inches (102 mm), and shall each have a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84.

Exception: Prefabricated or factory-manufactured panels having minimum 0.020-inch (0.51 mm) aluminum facings and a total thickness of 0.25 inch (6.4 mm) or less are permitted to be tested as an assembly where the foam plastic core is not exposed in the course of construction.

2603.5.5 Test standard. The wall assembly shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

Exception: One-story buildings complying with Section 2603.4.1.4.

2603.5.6 Label required. The edge or face of each piece of foam plastic insulation shall bear the label of an approved agency. The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or materials' performance characteristics and approved agency's identification.

2603.5.7 Ignition. Exterior walls shall not exhibit sustained flaming where tested in accordance with NFPA 268. Where a material is intended to be installed in more than one thickness, tests of the minimum and maximum thickness intended for use shall be performed.

Exception: Assemblies protected on the outside with one of the following:

1. A thermal barrier complying with Section 2603.4.
2. A minimum 1 inch (25 mm) thickness of concrete or masonry.
3. Glass-fiber-reinforced concrete panels of a minimum thickness of 0.375 inch (9.5 mm).
4. Metal-faced panels having minimum 0.019-inch-thick (0.48 mm) aluminum or 0.016-inch-thick (0.41 mm) corrosion-resistant steel outer facings.
5. A minimum 0.875 inch (22.2 mm) thickness of stucco complying with Section 2510.

2603.6 Roofing. Foam plastic insulation meeting the requirements of Sections 2603.2, 2603.3 and 2603.4 shall be permitted as part of a roof-covering assembly, provided the assembly with the foam plastic insulation is a Class A, B or C roofing assembly where tested in accordance with ASTM E 108 or UL 790.

2603.7 Plenums. Foam plastic insulation shall not be used as interior wall or ceiling finish in plenums except as permitted in Section 2604 or when protected by a thermal barrier in accordance with Section 2603.4.

2603.8 Protection from termite damage.

2603.8.1 Foam-plastic insulation including, but not limited to, extruded or expanded polystyrene or polyisocyanurate shall not be installed below grade on foundation walls or below grade on the exterior of slab foundations.

Exceptions:

1. When in addition to the requirements of Section 2304.11.6, an approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
2. Within Types I and II-B construction.
3. On the interior side of basement walls.

2603.8.2 Clearance between earth and foam plastics applied to the exterior wall shall be not less than 6 inches (152 mm).

Figure 2603.8 Termite Infestation Probability Map. Reserved.

2603.9 Special approval. Foam plastic shall not be required to comply with the requirements of Sections 2603.4 through 2603.7 where specifically approved based on large-scale tests such as, but not limited to, NFPA 286 (with the acceptance criteria of Section 803.2), FM 4880, UL 1040 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use. Foam plastics that are used as interior finish on the basis of special tests shall also conform to the flame spread requirements of Chapter 8. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

SECTION 2604
INTERIOR FINISH AND TRIM

2604.1 General. Plastic materials installed as interior finish or trim shall comply with Chapter 8. Foam plastics shall only be installed as interior finish where approved in accordance with the special provisions of Section 2603.9. Foam plastics that are used as interior finish shall also meet the flame spread index requirements for interior finish in accordance with Chapter 8. Foam plastics installed as interior trim shall comply with Section 2604.2.

[F] 2604.2 Interior trim. Foam plastic used as interior trim shall comply with Sections 2604.2.1 through 2604.2.4.

[F] 2604.2.1 Density. The minimum density of the interior trim shall be 20 pcf (320 kg/m^3).

[F] 2604.2.2 Thickness. The maximum thickness of the interior trim shall be 0.5 inch (12.7 mm) and the maximum width shall be 8 inches (204 mm).

[F] 2604.2.3 Area limitation. The interior trim shall not constitute more than 10 percent of the aggregate wall and ceiling area of any room or space.

[F] 2604.2.4 Flame spread. The flame spread index shall not exceed 75 where tested in accordance with ASTM E 84. The smoke-developed index shall not be limited.

SECTION 2605
PLASTIC VENEER

2605.1 Interior use. Where used within a building, plastic veneer shall comply with the interior finish requirements of Chapter 8.

2605.2 Exterior use. Exterior plastic veneer shall be permitted to be installed on the exterior walls of buildings of any type of construction in accordance with all of the following requirements:

1. Plastic veneer shall comply with Section 2606.4.
2. Plastic veneer shall not be attached to any exterior wall to a height greater than 50 feet (15 240 mm) above grade.
3. Sections of plastic veneer shall not exceed 300 square feet (27.9 m^2) in area and shall be separated by a minimum of 4 feet (1219 mm) vertically.

   Exception: The area and separation requirements and the smoke-density limitation are not applicable to plastic veneer applied to buildings constructed of Type VB construction, provided the walls are not required to have a fire-resistance rating.

SECTION 2606
LIGHT-TRANSMITTING PLASTICS

2606.1 General. The provisions of this section and Sections 2607 through 2611 shall govern the quality and methods of application of light-transmitting plastics for use as light-transmitting materials in buildings and structures. Foam plastics shall comply with Section 2603. Light-transmitting plastic materials that meet the other code requirements for walls and roofs shall be permitted to be used in accordance with the other applicable chapters of the code.

2606.2 Approval for use. Sufficient technical data shall be submitted to substantiate the proposed use of any light-transmitting material, as approved by the building official and subject to the requirements of this section.

2606.3 Identification. Each unit or package of light-transmitting plastic shall be identified with a mark or decal satisfactory to the building official, which includes identification as to the material classification.

2606.4 Specifications. Light-transmitting plastics, including thermoplastic, thermosetting or reinforced thermosetting plastic material, shall have a self-ignition temperature of 650°F (343°C) or greater where tested in accordance with ASTM D 1929; a smoke-developed index not greater than 450 where tested in the manner intended for use in accordance with ASTM E 84, or not greater than 75 where tested in the thickness

intended for use in accordance with ASTM D 2843 and shall conform to one of the following combustibility classifications:

Class CC1: Plastic materials that have a burning extent of 1 inch (25 mm) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D 635,

Class CC2: Plastic materials that have a burning rate of 2.5 inches per minute (1.06 mm/s) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D 635.

2606.5 Structural requirements. Light-transmitting plastic materials in their assembly shall be of adequate strength and durability to withstand the loads indicated in Chapter 16. Technical data shall be submitted to establish stresses, maximum unsupported spans and such other information for the various thicknesses and forms used as deemed necessary by the building official.

2606.6 Fastening. Fastening shall be adequate to withstand the loads in Chapter 16. Proper allowance shall be made for expansion and contraction of light-transmitting plastic materials in accordance with accepted data on the coefficient of expansion of the material and other material in conjunction with which it is employed.

2606.7 Light-diffusing systems. Unless the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, light-diffusing systems shall not be installed in the following occupancies and locations:

1. Group A with an occupant load of 1,000 or more.
2. Theaters with a stage and proscenium opening and an occupant load of 700 or more.
3. Group I-2.
4. Group I-3.
5. Exit stairways and exit passageways.

2606.7.1 Support. Light-transmitting plastic diffusers shall be supported directly or indirectly from ceiling or roof construction by use of noncombustible hangers. Hangers shall be at least No. 12 steel-wire gage (0.106 inch) galvanized wire or equivalent.

2606.7.2 Installation. Light-transmitting plastic diffusers shall comply with Chapter 8 unless the light-transmitting plastic diffusers will fall from the mountings before igniting, at an ambient temperature of at least 200°F (111°C) below the ignition temperature of the panels. The panels shall remain in place at an ambient room temperature of 175°F (79°C) for a period of not less than 15 minutes.

2606.7.3 Size limitations. Individual panels or units shall not exceed 10 feet (3048 mm) in length nor 30 square feet (2.79 m^2) in area.

2606.7.4 Fire suppression system. In buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, plastic light-diffusing systems shall be protected both above and below unless the sprinkler system has been specifically approved for installation only above the light-diffusing system. Areas of light-diffusing systems that are protected in accordance with this section shall not be limited.

2606.7.5 Electrical luminaires. Light-transmitting plastic panels and light-diffuser panels that are installed in approved electrical luminaires shall comply with the requirements of Chapter 8 unless the light-transmitting plastic panels conform to the requirements of Section 2606.7.2. The area of approved light-transmitting plastic materials that are used in required exits or corridors shall not exceed 30 percent of the aggregate area of the ceiling in which such panels are installed, unless the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2606.8 Partitions. Light-transmitting plastics used in or as partitions shall comply with the requirements of Chapters 6 and 8.

2606.9 Bathroom accessories. Light-transmitting plastics shall be permitted as glazing in shower stalls, shower doors, bathtub enclosures and similar accessory units. Safety glazing shall be provided in accordance with Chapter 24.

2606.10 Awnings, patio covers and similar structures. Awnings constructed of light-transmitting plastics shall be constructed in accordance with the provisions specified in Section 3105 and Chapter 32 for projections. Patio covers constructed of light-transmitting plastics shall comply with Section 2606. Light-transmitting plastics used in canopies at motor fuel-dispensing facilities shall comply with Section 2606, except as modified by Section 406.5.2.

2606.11 Greenhouses. Light-transmitting plastics shall be permitted in lieu of plain glass in greenhouses.

2606.12 Solar collectors. Light-transmitting plastic covers on solar collectors having noncombustible sides and bottoms shall be permitted on buildings not over three stories in height or 9,000 square feet (836.1 m^2) in total floor area, provided the light-transmitting plastic cover does not exceed 33.33 percent of the roof area for CC1 materials or 25 percent of the roof area for CC2 materials.

Exception: Light-transmitting plastic covers having a thickness of 0.010 inch (0.3 mm) or less or shall be permitted to be of any plastic material provided the area of the solar collectors does not exceed 33.33 percent of the roof area.

SECTION 2607
LIGHT-TRANSMITTING PLASTIC WALL PANELS

2607.1 General. Light-transmitting plastics shall not be used as wall panels in exterior walls in occupancies in Groups A-l, A-2, H, I-2 and I-3. In other groups, light-transmitting plastics shall be permitted to be used as wall panels in exterior walls, provided that the walls are not required to have a fire-resistance rating and the installation conforms to the requirements of this section. Such panels shall be erected and anchored on a foundation, waterproofed or otherwise protected from moisture absorption and sealed with a coat of mastic or other approved waterproof coating. Light-transmitting plastic wall panels shall also comply with Section 2606.

2607.2 Installation. Exterior wall panels installed as provided for herein shall not alter the type of construction classification of the building.

2607.3 Height limitation. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade plane, except as allowed by Section 2607.5.

2607.4 Area limitation and separation. The maximum area of a single wall panel and minimum vertical and horizontal separation requirements for exterior light-transmitting plastic wall panels shall be as provided for in Table 2607.4. The maximum percentage of wall area of any story in light-transmitting plastic wall panels shall not exceed that indicated in Table 2607.4 or the percentage of unprotected openings permitted by Section 704.8, whichever is smaller.

Exceptions:

1. In structures provided with approved flame barriers extending 30 inches (760 mm) beyond the exterior wall in the plane of the floor, a vertical separation is not required at the floor except that provided by the vertical thickness of the flame barrier projection.
2. Veneers of approved weather-resistant light-transmitting plastics used as exterior siding in buildings of Type V construction in compliance with Section 1406.
3. The area of light-transmitting plastic wall panels in exterior walls of greenhouses shall be exempt from the area limitations of Table 2607.4 but shall be limited as required for unprotected openings in accordance with Section 704.8.

2607.5 Automatic sprinkler system. Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum percentage area of exterior wall in any story in light-transmitting plastic wall panels and the maximum square footage of a single area given in Table 2607.4 shall be increased 100 percent, but the area of light-transmitting plastic wall panels shall not exceed 50 percent of the wall area in any story, or the area permitted by Section 704.8 for unprotected openings, whichever is smaller. These installations shall be exempt from height limitations.

2607.6 Combinations of glazing and wall panels. Combinations of light-transmitting plastic glazing and light-transmitting plastic wall panels shall be subject to the area, height and percentage limitations and the separation requirements applicable to the class of light-transmitting plastic as prescribed for light-transmitting plastic wall panel installations.

SECTION 2608
LIGHT-TRANSMITTING PLASTIC GLAZING

2608.1 Buildings of Type VB construction. Openings in the exterior walls of buildings of Type VB construction, where not required to be protected by Section 704, shall be permitted to be glazed or equipped with light-transmitting plastic. Light-transmitting plastic glazing shall also comply with Section 2606.

2608.2 Buildings of other types of construction. Openings in the exterior walls of buildings of types of construction other than Type VB, where not required to be protected by Section 704, shall be permitted to be glazed or equipped with light-transmitting plastic in accordance with Section 2606 and all of the following:

1. The aggregate area of light-transmitting plastic glazing shall not exceed 25 percent of the area of any wall face of the story in which it is installed. The area of a single pane of glazing installed above the first story above grade plane shall not exceed 16 square feet (1.5 m^2) and the vertical dimension of a single pane shall not exceed 4 feet (1219 mm).

   Exception: Where an automatic sprinkler system is provided throughout in accordance with Section 903.3.1.1, the area of allowable glazing shall be increased to a maximum of 50 percent of the wall face of the story in which it is installed with no limit on the

TABLE 2607.4
AREA LIMITATION AND SEPARATION REQUIREMENTS FOR LIGHT-TRANSMITTING PLASTIC WALL PANELS[a]

FIRE SEPARATION DISTANCE (feet)	CLASS OF PLASTIC	MAXIMUM PERCENTAGE AREA OF EXTERIOR WALL IN PLASTIC WALL PANELS	MAXIMUM SINGLE AREA OF PLASTIC WALL PANELS (square feet)	MINIMUM SEPARATION OF PLASTIC WALL PANELS (feet)	
				Vertical	Horizontal
Less than 6	—	Not Permitted	Not Permitted	—	—
6 or more but less than 11	CC1	10	50	8	4
	CC2	Not Permitted	Not Permitted	—	—
11 or more but less than or equal to 30	CC1	25	90	6	4
	CC2	15	70	8	4
Over 30	CC1	50	Not Limited	3[b]	0
	CC2	50	100	6[b]	3

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. For combinations of plastic glazing and plastic wall panel areas permitted, see Section 2607.6.

b. For reductions in vertical separation allowed, see Section 2607.4.

maximum dimension or area of a single pane of glazing.

2. Approved flame barriers extending 30 inches (762 mm) beyond the exterior wall in the plane of the floor, or vertical panels not less than 4 feet (1219 mm) in height, shall be installed between glazed units located in adjacent stories.

   Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

3. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade level.

   Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

SECTION 2609
LIGHT-TRANSMITTING PLASTIC ROOF PANELS

2609.1 General. Light-transmitting plastic roof panels shall comply with this section and Section 2606. Light-transmitting plastic roof panels shall not be installed in Groups H, I-2 and I-3. In all other groups, light-transmitting plastic roof panels shall comply with any one of the following conditions:

1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The roof construction is not required to have a fire-resistance rating by Table 601.
3. The roof panels meet the requirements for roof coverings in accordance with Chapter 15.

2609.2 Separation. Individual roof panels shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

Exceptions:

1. The separation between roof panels is not required in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The separation between roof panels is not required in low-hazard occupancy buildings complying with the conditions of Section 2609.4, Exception 2 or 3.

2609.3 Location. Where exterior wall openings are required to be protected by Section 704.8, a roof panel shall not be installed within 6 feet (1829 mm) of such exterior wall.

2609.4 Area limitations. Roof panels shall be limited in area and the aggregate area of panels shall be limited by a percentage of the floor area of the room or space sheltered in accordance with Table 2609.4.

Exceptions:

1. The area limitations of Table 2609.4 shall be permitted to be increased by 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Low-hazard occupancy buildings, such as swimming pool shelters, shall be exempt from the area limitations of Table 2609.4, provided that the buildings do not exceed 5,000 square feet (465 m^2) in area and have a minimum fire separation distance of 10 feet (3048 mm).
3. Greenhouses that are occupied for growing plants on a production or research basis, without public access, shall be exempt from the area limitations of Table 2609.4 provided they have a minimum fire separation distance of 4 feet (1220 mm).
4. Roof coverings over terraces and patios in occupancies in Group R-3 shall be exempt from the area limitations of Table 2609.4 and shall be permitted with light-transmitting plastics.

TABLE 2609.4
AREA LIMITATIONS FOR LIGHT-TRANSMITTING PLASTIC ROOF PANELS

CLASS OF PLASTIC	MAXIMUM AREA OF INDIVIDUAL ROOF PANELS (square feet)	MAXIMUM AGGREGATE AREA OF ROOF PANELS (percent of floor area)
CC1	300	30
CC2	100	25

For SI: 1 square foot = 0.0929 m^2.

SECTION 2610
LIGHT-TRANSMITTING PLASTIC SKYLIGHT GLAZING

2610.1 Light-transmitting plastic glazing of skylight assemblies. Skylight assemblies glazed with light-transmitting plastic shall conform to the provisions of this section and Section 2606. Unit skylights glazed with light-transmitting plastic shall also comply with Section 2405.5.

Exception: Skylights in which the light-transmitting plastic conforms to the required roof-covering class in accordance with Section 1505.

2610.2 Mounting. The light-transmitting plastic shall be mounted above the plane of the roof on a curb constructed in accordance with the requirements for the type of construction classification, but at least 4 inches (102 mm) above the plane of the roof. Edges of light-transmitting plastic skylights or domes shall be protected by metal or other approved noncombustible material, or the light-transmitting plastic dome or skylight shall be shown to be able to resist ignition where exposed at the edge to a flame from a Class B brand as described in ASTM E 108 or UL 790.

Exceptions:

1. Curbs shall not be required for skylights used on roofs having a minimum slope of three units vertical in 12 units horizontal (25-percent slope) in occupancies in Group R-3 and on buildings with a nonclassified roof covering.
2. The metal or noncombustible edge material is not required where nonclassified roof coverings are permitted.

2610.3 Slope. Flat or corrugated light-transmitting plastic skylights shall slope at least four units vertical in 12 units horizontal (4:12). Dome-shaped skylights shall rise above the mounting flange a minimum distance equal to 10 percent of the maximum span of the dome but not less than 3 inches (76 mm).

Exception: Skylights that pass the Class B Burning Brand Test specified in ASTM E 108 or UL 790.

2610.4 Maximum area of skylights. Each skylight shall have a maximum area within the curb of 100 square feet (9.3 m^2).

Exception: The area limitation shall not apply where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with Section 910.

2610.5 Aggregate area of skylights. The aggregate area of skylights shall not exceed $33^1/_3$ percent of the floor area of the room or space sheltered by the roof in which such skylights are installed where Class CC1 materials are utilized, and 25 percent where Class CC2 materials are utilized.

Exception: The aggregate area limitations of light-transmitting plastic skylights shall be increased 100 percent beyond the limitations set forth in this section where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with Section 910.

2610.6 Separation. Skylights shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

Exceptions:

1. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. In Group R-3, multiple skylights located above the same room or space with a combined area not exceeding the limits set forth in Section 2610.4.

2610.7 Location. Where exterior wall openings are required to be protected in accordance with Section 704, a skylight shall not be installed within 6 feet (1829 mm) of such exterior wall.

2610.8 Combinations of roof panels and skylights. Combinations of light-transmitting plastic roof panels and skylights shall be subject to the area and percentage limitations and separation requirements applicable to roof panel installations.

SECTION 2611
LIGHT-TRANSMITTING PLASTIC INTERIOR SIGNS

2611.1 General. Light-transmitting plastic interior wall signs shall be limited as specified in Sections 2611.2 through 2611.4. Light-transmitting plastic interior wall signs in covered mall buildings shall comply with Section 402.15. Light-transmitting plastic interior signs shall also comply with Section 2606.

2611.2 Aggregate area. The sign shall not exceed 20 percent of the wall area.

2611.3 Maximum area. The sign shall not exceed 24 square feet (2.23 m^2).

2611.4 Encasement. Edges and backs of the sign shall be fully encased in metal.

SECTION 2612
HIGH-VELOCITY HURRICANE ZONES — PLASTICS

2612.1 General.

2612.1.1 Plastic materials used as structural elements shall be designed by methods admitting of rational analysis according to established principles of mechanics.

2612.1.2 Plastic materials may be permitted as set forth herein. The physical properties, such as, not but limited to, weather-resistance, fire-resistance and flame spread characteristics, shall comply with the requirements of this code.

2612.1.3 Application and plans submitted for proposed construction shall identify the plastic material intended for use and such material shall be stamped or otherwise marked so as to be readily identifiable in the field.

2612.1.4 Plastic structural elements, other than sheets, shall be designed by a Florida-registered professional engineer or a Florida-registered architect.

2612.2 Definitions.

APPROVED FOAM PLASTIC. An approved foam plastic shall be any thermoplastic, thermosetting or reinforced thermosetting plastic material that has a minimum self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929. It shall have a smoke density rating not greater than 450 and a flame spread of 75 or less when tested in accordance with ASTM E 84.

APPROVED PLASTIC. An approved plastic shall be any thermoplastic, thermosetting or reinforced thermosetting plastic material which has a self-ignition temperature of 650°F (343°C), or greater when tested in accordance with ASTM D 1929, a smoke density rating no greater than 450 when tested in the way intended for use by ASTM E 84 or a smoke density rating no greater than 75 when tested in the thickness intended for use according to ASTM D 2843 and which meets one of the following combustibility classifications:

Class C-1. Plastic materials that have a burning extent of 1 inch per minute (25.4 mm) or less when tested in nominal 0.060 inch (1.5 mm) thickness or in the thickness intended for use by ASTM D 635.

Class C-2. Plastic materials that have a burning rate of $2^1/_2$ inches (64 mm) per minute or less when tested in nominal 0.060 inch (1.5 mm) thickness or in the thickness intended for use by ASTM D 635.

Approved plastics for outdoor exposure shall be evaluated for outdoor durability in accordance with the *Voluntary Standard Uniform Load Test Procedure for Thermoformed Plastic Domed Skylights,* of the AAMA/WDMA 101/IS2/NAFS, *Voluntary Performance Specification for Windows, Skylights and Glass Doors,* as follows:

1. Outdoor exposure conditions: Specimen exposed in Florida at 45 degree south exposure for a period of five years.
    a. Impact testing, after exposure test as above, per ASTM D 256, and
    b. Tensile testing on controlled and weathered specimen per ASTM D 638. Yield strength difference between controlled and weathered specimen shall not exceed 10 percent.
2. Alternate:
    a. Exposure to xenon arc weatherometer using a 6500-watt lamp per ASTM G 155 and ASTM D 2565 for a period of 4,500 hours.
    b. Impact testing, after exposure test as above, per ASTM D 256, and
    c. Tensile testing on controlled and weathered specimen per ASTM D 638. Yield strength difference between controlled and weathered specimen shall not exceed 10 percent.

FINISH RATING. The time, as determined in accordance with ASTM E 119, at which a thermal barrier reaches a temperature rise of 240°F (116°C), above ambient or an individual temperature rise of 324°F (162°C), above ambient as measured on the plane of the thermal barrier nearest to foam plastic.

FLAME SPREAD RATING. The measurement of flame spread on the surface of materials or their assemblies as determined in accordance with ASTM E 84.

GLASS FINER REINFORCED PLASTIC. Plastic reinforced with glass fibers having not less than 20 percent of glass fibers by weight.

LIGHT DIFFUSING SYSTEM. A suspended construction consisting in whole or in part of lenses, panels, grids or baffles suspended below independently mounted electrical lighting sources.

PLASTIC GLAZING. Plastic materials that are glazed or set in frame or sash and not held by mechanical fasteners which pass through the glazing material.

PLASTIC ROOF PANELS. Plastic materials that are fastened to structural panels or sheathing and which are used as light transmitting media in the plane of the roof.

PLASTIC SANDWICH PANELS. Panels of foam plastic sandwiched between incombustible skins.

PLASTIC WALL PANELS. Plastic materials that are fastened to structural panels or sheathing and which are used as light transmitting medium in exterior walls.

SKYLIGHT. An assembly that includes plastic materials used as light transmitting medium and which is located above the plane of the roof.

SMOKE DENSITY. A numerical value of smoke development, determined by measuring the area under the curve of light absorption versus time, in accordance with ASTM E 84 or ASTM D 2843.

THERMOPLASTIC MATERIALS. A plastic material that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

THERMOSETTING MATERIALS. A plastic material that is capable of being changed into a substantially nonreformable product when cured.

2612.3 Foam plastics.

2612.3.1 General.

2612.3.1.1 Except as otherwise provided herein, all foam plastics or foam plastic cores in manufactured assemblies used in building construction shall have a flame spread rating of not more than 75 and shall have a smoke-developed rating of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E 84.

2612.3.1.2 Except as otherwise provided herein, foam plastics shall be separated from the interior walls, floors and ceiling herein of a building by an approved thermal barrier of $^1/_2$ inch (13 mm) gypsum wallboard or equivalent thermal barrier material which will limit the average temperature rise of the unexposed surface to not more than 259°F (126°C), after 15 minutes of fire exposure complying with the ASTM E 119 standard time-temperature curve.

2612.3.1.3 Foam plastics trim, defined as picture molds, chair rails, baseboards, handrails, ceiling beams, door trim and window trim, shall also meet requirements for interior finish in Section 805.

2612.3.1.4 Foam plastic not meeting the requirements of this section may be specifically approved on the basis of approved tests such as, but not limited to, a tunnel test in accordance with ASTM E 84, FM procedure 4880, UL Subject 1040, ASTM E 152 or the room test procedure described in SPI Bulletin PPICC 401 or fire tests related to actual end-use configuration. The specific approval may be based on the end use, quantity, location and similar considerations where such tests would not be applicable or practical.

2612.3.2 Specific requirements. The following specific requirements shall apply to all uses of foam plastics unless otherwise permitted in this code.

2612.3.2.1 Cold storage buildings.

2612.3.2.1.1 Foam plastics when tested in a thickness of 4 inches (102 mm), may be used in a thickness up to 10 inches (254 mm) when the building is equipped with an approved automatic fire suppression system.

2612.3.2.1.2 Such approved automatic fire suppression system shall be provided in both the cold storage room and the part of the building in which the room is located.

2612.3.2.2 Walk-in coolers.

2612.3.2.2.1 Foam plastic having a maximum flame spread of 75 may be used in a thickness up to 4 inches (102 mm) in free-standing walk-in cooler or freezer units less than 400 square feet (37 m^2) in floor area

without a thermal barrier and without an automatic fire suppression system when the foam plastic is covered by a metal facing not less than 0.032 inch (0.813 mm) thick aluminum or corrosion-resistant steel having a minimum of base metal thickness of 0.016 inch (0.406 mm).

2612.3.2.2.2 When protected by a thermal barrier, the foam plastic may be used in a thickness up to 10 inches (254 mm).

2612.3.2.3 Exterior walls of one-story buildings.

2612.3.2.3.1 Foam-plastic insulation having a flame spread of 25 or less may be used without thermal barriers in or on exterior fire resistive incombustible walls in a thickness of not less than 0.032 inch (0.813 mm) aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.0160 inch (0.406 mm), and the insulated interior area is protected with automatic sprinklers.

2612.3.2.3.2 Foam plastic may be used without the thermal barrier described herein when it is protected by a minimum of 1 inch (25.4 mm) thickness of masonry or concrete.

2612.3.2.4 Exterior walls of multistory buildings.

2612.3.2.4.1 Where walls face a street or permanent open space of 30 feet (9 m) or more, foam-plastic insulation may be used in a nonfire-rated exterior wall assembly.

2612.3.2.4.2 Where a separation of less than 30 feet (9 m) exists, foam plastic may be used within exterior walls, provided the wall assembly affords the required fire resistivity.

2612.3.2.4.3 Foam-plastic insulation shall be separated from the building interior by a thermal barrier having an index of 15 unless a specific approval is obtained on the basis of Section 2612.3.1.4.

2612.3.2.4.4 The amount of foam plastic in any portion of the wall or panel shall not exceed 6000 Btu/square foot (68.1 MJ/m^2) of projected area as determined by tests conducted in accordance with NFPA 259.

2612.3.2.4.5 The foam plastic core, coatings and facings shall have a flame spread rating of 25 or less and smoke-developed rating of 450 or less as determined in accordance with ASTM E 84.

2612.3.2.4.6 Facing, coating and core materials shall be mechanically or adhesively fastened to each other and to building members to prohibit failure in bond as a result of temperatures which may be experienced in a building fire from wind loads or other conditions.

2612.3.2.4.7 Results of diversified or full-scale fire tests reflecting an end-use configuration shall be submitted to the building official demonstrating the assembly in its final form does not propagate the flame over the surface or through the core when exposed on the exterior face to a fire source.

2612.3.2.5 Roofing.

2612.3.2.5.1 Foam plastic may be used in a roof covering assembly without the thermal barrier when the foam is separated from the interior of the building by plywood sheathing not less than $^1/_2$ inch (12.7 mm) in thickness bonded with exterior glue, with edge supported by blocking, tongue-and-grooved joints or other approved type of edge support, or an equivalent or better material or system.

2612.3.2.5.2 Foam-plastic roof insulation that complies with FM 4450 or UL 1256 need not meet the requirements of Section 2612.3.1.2.

2612.3.2.5.3 For all roof applications, the smoke developed rating shall not be limited.

2612.3.2.6 Attics and crawl spaces.

2612.3.2.6.1 Within an attic or crawl space where entry is made for service of utilities, exposed foam plastics shall be protected against ignition by 1-inch-thick (25 mm) mineral fiber insulation, $^1/_4$-inch-thick (6.4 mm) plywood, particleboard or hardboard or $^3/_8$-inch (9.5 mm) gypsum wall board, corrosion-resistant steel having a base metal thickness of 0.0160 inch (0.406 mm), or other equivalent material installed in such manner that the foam plastic is not exposed.

2612.3.2.6.2 The protective covering shall also meet the requirements for the type of construction.

2612.3.2.7 Doors.

2612.3.2.7.1 Where doors are permitted without a fire-resistance rating, foam plastic having a flame spread rating of 75 or less may be used as a core material when the door facing is metal having a minimum thickness of 0.032 inch (0.813 mm) aluminum or sheet steel having a minimum thickness of 0.0160 inch (0.406 mm).

2612.3.2.7.2 There shall be no thermal barrier requirements for these doors.

2612.4 Light-transmitting plastics.

2612.4.1 General.

2612.4.1.1 The provisions of this section shall govern the quality and methods of application of plastics for use as light transmitting media within buildings and structures.

2612.4.1.2 All plastics to be used according to the provisions of this section shall be approved plastic and conform to Section 2612.1 and Section 2612.2.

Exception: Roof coverings over terraces and patios of one- and two-family dwellings shall be permitted with approved plastics.

2612.4.2 Glazing of openings in nonfire-rated walls.

2612.4.2.1 Doors, sash and framed openings which are not required to be fire rated may be glazed with approved plastic materials in buildings of Type III-B construction.

2612.4.2.2 In all other types of construction openings not required to be fire-rated may be glazed or equipped with approved plastic material subject to the requirements listed below.

2612.4.2.2.1 The area of such glazing shall not exceed 25 percent of the wall face of the story in which it is installed.

2612.4.2.2.2 The area of a unit or pane of glazing installed above the first story shall not exceed 16 square feet (1.49 m^2) and the vertical dimension of a unit or pane shall not exceed 4 feet (1219 mm). There shall be a minimum 3 feet (914 mm) vertical spandrel wall between stories.

2612.4.2.2.3 Approved plastics shall not be installed more than 75 feet (22.9 m) above grade level except as provided in Section 2612.4.2.2.4.

2612.4.2.2.4 Approved thermoplastic materials may be installed in areas up to 50 percent of the wall area of each story in structures less than 150 feet (45.7 m) in height if continuous architectural projections constitute an effective fire barrier extending at least 3 feet (914 mm) from the surface of the wall on which the glazing is installed and are provided on each floor above the first floor. The size and the dimensions of individual units shall not be limited in such installations except as required to meet structural loading requirements.

2612.4.2.3 Area increase based on fire protection. In buildings or portions thereof protected by approved automatic, fire extinguishing systems, the area of glazing permitted by Section 2612.4.2.2.1 may be increased by 100 percent.

2612.4.3 Exterior nonfire-rated wall panels.

2612.4.3.1 General. Approved plastic materials may be used as wall panels, in exterior walls not required to heave a fire rating subject to the requirements in this section.

2612.4.3.1.1 Installation. Exterior wall panels installed as provided herein shall not alter the type of construction classification of the building.

2612.4.3.1.2 Height limitation. Approved plastics shall not be installed more than 75 feet (22.9 m) above grade level except as permitted by Section 2612.4.3.1.4 (Exception 3).

2612.4.3.1.3 Area limitation and separation. Area limitation and separation requirements of exterior wall panels shall be provided in Table 2612.4.3.1.3.

2612.4.3.1.4 Combination of glazing and wall panels. Combinations of plastic glazing and plastic wall panels shall be subject to the area, height and percentage limitations and separation requirements applicable to the class of plastics as prescribed for wall panel installations.

Exceptions:

1. Structures which provide continuous architectural projections extending at least 36 inches (914 mm) from the surface of the wall in which plastic wall panels are installed shall not be required to provide vertical separation at that floor.
2. Area increase based on in fire protection. In buildings or portions thereof protected by approved automatic fire extinguishing systems, the maximum percent area of plastic panes in exterior walls and the maximum square feet of separate panel are given in Table 2612.4.3.1.3 may be increased 100 percent but the area of plastic wall panels shall not exceed 50 percent of the wall area.
3. Approved thermoplastic materials may be installed in areas up to 50 percent of the wall area of each story in structures less than 150 feet (45.7 m) in width if continuous architectural projections constitute an effective fire barrier extending at least 3 feet (914 mm) from the surface of the wall on which the panels are installed and are provided on each floor above the first floor.
4. The use of plastics shall not be permitted in exterior walls in Group A, H and I occupancies.

TABLE 2612.4.3.1.3
AREA LIMITATION AND SEPARATION REQUIREMENTS FOR PLASTIC WALL PANELS IN NONFIRE-RATED WALLS

FIRE SEPARATION (FT)	CLASS OF PLASTIC	MAX. AGGREGATE AREA (% OF EXTERIOR WALL)	MAX. SEPARATED PANEL AREA (SQ FT)	MINIMUM SEPARATION OF PANELS (FT)	
				VERTICAL	HORIZONTAL
10 up to and including 30.	C1	25	90	6	4
	C2	15	70	8	4
Over 30	C1	50	no limit	3[1]	0
	C2	50	100	6[1]	3

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.
Note 1: See Exception 1 to Section 2612.4.3.1.

2612.4.4 Roof panels.

2612.4.4.1 General. Approved plastic roof panels may be installed as follows.

2612.4.4.1.1 Where the roof is not required to have a fire rating.

2612.4.4.1.2 Where the roof panels meet the requirements for roof coverings of the particular occupancy.

2612.4.4.1.3 In roofs of buildings protected by an approved automatic fire-extinguishing system.

Exception: The use of plastics shall not be permitted in roofs of Group A, H and I occupancies.

2612.4.4.2 Separations. Individual roof panels shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

2612.4.4.3 Location. Where exterior wall openings are required to be fire rated, a roof panel or unit shall not be installed within 6 feet (1829 mm) of such exterior wall.

2612.4.4.4 Area limitations. Roof panels or units shall be limited in area, according to provisions set forth in Table 2612.4.4.4.

2612.4.5 Skylight assemblies. Skylight assemblies may be glazed with approved plastic materials in accordance with this section.

2612.4.5.1 Mounting.

2612.4.5.1.1 The plastic shall be mounted a minimum of 4 inches (102 mm) above the plane of the roof on a curb constructed in accordance with requirements of types of construction.

2612.4.5.1.2 Dome-shape skylights shall rise above the mounting flange a minimum distance equal to 10 percent of the maximum span of the dome, but not less than 4 inches (102 mm).

2612.4.5.1.3 The edges of the skylights shall be protected by incombustible material in Types I, IV and V-B construction.

2612.4.5.2 Maximum area of skylight units. Each skylight unit shall have a maximum area within the curb of 100 square feet (9.3 m^2) for Class C-2 material and 200 square feet (18.6 m^2) for Class C-1 material.

2612.4.5.3 Aggregate area of skylights. The aggregate area of skylights shall not exceed 33 percent when Class C-1 materials are used and 25 percent when Class C-2 materials are used, of the floor area of the room or space sheltered by the roof in which they are installed.

2612.4.5.4 Separation. Skylights shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

2612.4.5.5 Location. Where exterior wall openings are required to be fire rated, a skylight shall not be installed within 6 feet (1829 mm) of such exterior wall.

Exceptions:

1. Skylight assemblies may not be glazed with approved plastic materials in buildings of Group H and I occupancies.
2. The aggregated area of approved plastic skylights may be increased 100 percent beyond the limitations set forth herein if the skylights are used as an automatic fire venting system or if the building is equipped with an automatic fire extinguishing system.
3. When a building not more than one story in height has a minimum distance separation from other buildings of 30 feet (9.1 m) and is not used as an enclosed means of egress, skylights in such a building need not comply with the requirements set forth in this paragraph.
4. When skylights used in a building are made of approved plastic materials that meet the fire-rated requirements of the roof of the building, such skylight assemblies need not comply with the requirements set forth in this paragraph.
5. Skylights installed in detached buildings of Group R3 occupancy, Types IV and III-B need not comply with this section.

2612.4.6 Light diffusing systems.

2612.4.6.1 General.

2612.4.6.1.1 Light diffusing systems shall not be installed in Group I and H occupancies or in exitways unless they are protected with an approved automatic fire extinguishing system.

2612.4.6.1.2 Approved plastic diffusers shall comply with the flame spread requirements for interior finishes, unless the individual plastic panels will fall from their mountings before igniting at an ambient temperature of at least 200°F (93°C) below their ignition temperature. The panels must, however, remain in place at an ambient room temperature of 175°F (79°C) for a period of not less than 15 minutes.

2612.4.6.1.3 Location. Where fire-rated ceiling assemblies are required, plastic diffusers, if used, shall be located below such assemblies.

2612.4.6.2 Installation. Plastic diffusers shall be supported directly or indirectly from ceiling or roof construction by use of incombustible hangers. Hangers shall be at least No. 12 Steel Wire Gage [0.0106 inch (0.27 mm)] galvanized wire or equivalent.

2612.4.6.3 Size limitations. Individual panels or units shall not exceed 10 feet (3 m) in length or 30 square feet (2.8 m^2) in area.

2612.4.6.4 When buildings are protected by an automatic fire extinguishing system, this section shall apply to light diffusing systems within such buildings.

2612.4.6.4.1 Fire-extinguishing systems shall be located above and below the light diffusing system

TABLE 2612.4.4.4
AREA LIMITATIONS FOR ROOF PANELS

CLASS OF PLASTIC	MAX. SEPARATED PANEL AREA (SQ FT)	MAX. AGGREGATE AREA (% OF FLOOR AREA)
C1	300	30
C2	100	25

For SI: 1 square foot = 0.0929 m^2.

unless specifically approved for above such system only.

2612.4.6.4.2 Areas of light-diffusing systems protected by a fire-extinguishing system shall not have to comply with the size limitations set forth in this section.

2612.4.6.5 Electrical lighting fixtures.

2612.4.6.5.1 Plastic light-transmitting panels and light-diffuser panels installed in product approval electrical lighting fixtures shall have flame spread ratings compatible with the occupancy of the building.

2612.4.6.5.2 The area of approved plastic materials when used in required fire exits or corridors shall not exceed 30 percent of the aggregate area of the ceiling in which they are installed, unless the occupancy is protected by an approved fire extinguishing system.

2612.4.7 Partitions. Approved light-transmitting plastics may be used in or as partitions provided the requirement of the types of construction are met.

2612.4.8 Bathroom accessories. Approved plastics shall be permitted as glazing in shower stalls, shower doors, bathtub enclosures and similar accessory units and shall conform to 16 CFR 1205 and the *Safety Standard for Architectural Glazing Materials.*

2612.4.9 Awnings and similar structures. Approved lighttransmitting plastics may be used on or as awnings and similar structures when in conformance with provisions as set forth in other sections of this code.

CHAPTER 27
ELECTRICAL

SECTION 2701
GENERAL

2701.1 Scope. This chapter governs the electrical components, equipment and systems used in buildings and structures covered by this code. Electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of NFPA 70, *National Electrical Code*, except Article 80.

[F] SECTION 2702
EMERGENCY AND STANDBY POWER SYSTEMS

2702.1 Installation. Emergency and standby power systems shall be installed in accordance with the NFPA 70, *National Electrical Code*, NFPA 110 and NFPA 111.

2702.1.1 Stationary generators. Reserved.

2702.2 Where required. Reserved.

2702.3 Maintenance. Reserved.

SECTION 2703
CROSS REFERENCES

2703.1 Cross references. See Table 2703.

SECTION 2704
BONDING METAL FRAMING MEMBERS

2704.1 Bonding metal framing members. Metal framing members shall be bonded to the equipment grounding conductor for the circuit that may energize the framing and be sized in accordance with the *National Electric Code* Table 250.122. For the purpose of this section, a grounded metal outlet box attached to the framing shall be permitted.

TABLE 2703
CROSS REFERENCES DEFINING ELECTRICAL REQUIREMENTS OF THE *FLORIDA BUILDING CODE*

Florida Building Code—Building			
Section		**Section**	
Chapter 1	Administration	Chapter 7	Fire-Resistance-Rated Construction
101	General	712	Penetrations
102	Applicability	714	Fire-Resistance Rating of Structural Members
105	Permits	715	Opening Protective
106	Construction Documents	716	Ducts and Air Transfer Openings
107	Temporary Structures and Uses		
108	Fees	Chapter 9	Fire Protection Systems
109	Inspections	901	General
111	Service Utilities	902	Definitions
		903	Automatic Sprinkler Systems
Chapter 2	Definitions	904	Alternative Automatic Fire-Extinguishing
202	Definitions		Systems
		907	Fire Alarm and Detection Systems
Chapter 3	Use and Occupancy Classification	908	Emergency Alarm Systems
302	Classification	909	Smoke Control Systems
306	Factory Group F	910	Smoke and Heat Vents
307	High -Hazard Group H	911	Fire Command Center
Chapter 4	Special Detailed Requirement	Chapter 10	Means of Egress
	Based on Use and Occupancy	1006	Means of Egress Illumination and Signs
402	Covered Mall Buildings	1008	Doors, Gates and Turnstiles
403	High-Rise Buildings	1033	Day Care
311	Storage Group S		

(continued)

TABLE 2703—continued
CROSS REFERENCES DEFINING ELECTRICAL REQUIREMENTS OF THE *FLORIDA BUILDING CODE*

Section		Section	
Chapter 4	Special Detailed Requirement	Chapter 11	Florida Accessibility Code For Building Construction
(continued)	Based on Use and Occupancy		Part A
404	Atriums	11-3	Miscellaneous Instructions and Definitions
405	Underground Buildings	11-4	Accessible Elements and Spaces: Scope
			and Technical Requirements
406	Motor-Vehicle-Related Occupancies	11-9	Accessible Transient Lodging
407	Group I-2		Part B
408	Group I-3	5	Guidelines
409	Motion Picture Projection Rooms		
412	Aircraft-Related Occupancies	Chapter 12	
414	Hazardous Materials	1205	Lighting
415	Groups H-1, H-2, H-3, H-4 and H-5		
419	Hospitals	Chapter 13	Energy Efficiency
420	Nursing Homes	13-101	Scope
421	Ambulatory Surgical Centers	Subchapter	
423	State Requirements for Educational	13-2	Definitions
	Facilities	13-3	Referenced Standards and Organizations
424	Swimming Pools and Bathing Places	13-4	Commercial Building Compliance Methods
	(Public and Private)	13-6	Residential Building Compliance Methods
425	Public Lodging Establishments		
426	Public Food Service Establishments	Appendix 13-B	Supplemental Information for Subchapter 13-4
427	Mental Health Programs		
428	Manufactured Buildings	Chapter 26	Plastic
431	Transient Public lodging Establishments	2606	Light-Transmitting Plastics
435	Control of Radiation Hazards	2611	Light-Transmitting Plastic Interior Signs
436	Day Care Occupancies	2612	High-Velocity Hurricane Zones—Plastics
		Chapter 27	Electrical
		2701	General
		2702	Emergency and Standby Power Systems
		Chapter 30	Elevators and Conveying Systems
		3003	Emergency Operations
		3005	Conveying Systems
		3006	Machine Rooms
		3011	Alterations to Electric and Hydraulic
			Elevators and Escalators
		Chapter 31	Special Construction
		3102	Membrane Structures
		3108	Radio and Television Towers
		3112	Lighting, Mirrors, Landscaping
		Chapter 33	
		3306	Protection of Pedestrians
		3310	Exits
		Chapter 35	Referenced Standards

(continued)

TABLE 2703—continued
Florida Building Code—Residential

Section		Section	
Chapter 3	Building Planning	Chapter 24	Fuel Gas
R303	Light, Ventilation and Heating	G2403 (202)	General Definitions
R313	Smoke Alarms	G2410 (309)	Electrical
R317	Dwelling Unit Separation	G2411 (310)	Electrical Bonding
		G2440 (615)	Sauna Heaters
Chapter 8	Roof -Ceiling Construction		
R808	Insulation Clearance	Chapter 33	General Requirements Electrical
		E3301	General Requirements Electrical
Chapter 13	General Mechanical System		
	Requirements	Chapter 43	Referenced Standards
M1303	Labeling of Equipment		
M1305	Appliance Access		
	Florida Building Code—Existing		
Section		**Section**	
Chapter 3	Classification of Work	Chapter 11	Relocated or Moved Buildings
305	Alterations-Level 3	1102	Requirements
Chapter 4	Repairs	Chapter 12	Compliance Alternatives
401	General	1201	General
408	Electrical		
		Chapter 14	Referenced Standards
Chapter 5	Alterations-Level 1		
508	Electrical	Appendix B	Standard for Rehabilitation
Chapter 6	Alterations-Level 2		
608	Electrical		
Chapter 8	Change of Occupancy		
808	Electrical		
811	Other Requirements		
Chapter 9	Additions		
901	General		
904	Smoke Alarms in Occupancy		
	Groups R-3 and R-4		

(continued)

TABLE 2703—continued
Florida Building Code—Mechanical

Section		Section	
Chapter 3	General Regulations	Chapter 9	Specific Appliances, Fireplaces and Solid Fuel-Burning Equipment
301	General	912	Infrared Radiant Heaters
306	Access and Service Space	917	Cooking Appliances
		918	Forced-Air Warm-Air Furnaces
Chapter 5	Exhaust Systems	924	Stationary Fuel Cell Power Plants
502	Required Systems	927	Residential Electric Duct Heaters
503	Motors and Fans	928	Vented Residential Floor Furnaces
504	Clothes Dryer Exhaust		
509	Fire Suppression Systems	Chapter 10	Boilers, Water Heaters and
513	Smoke Control Systems		Pressure Vessels
		1001	General
Chapter 6	Duct Systems	1004	Boilers
601	General	1006	Safety and Pressure Relief Valves
602	Plenums		And Controls
606	Smoke Detection System Control		
607	Ducts and Air Transfer Openings	Chapter 11	Refrigeration
		1104	System Application Requirements
Chapter 8	Chimneys and Vents	1105	Machinery Room, General Requirements
801	General	1106	Machinery Room, Special Requirements
804	Direct-Vent, Integral Vent and		
	Mechanical Draft System	Chapter 15	Referenced Standards

Florida Building Code—Plumbing

Section		Section	
Chapter 6	Water Supply and Distribution	Part II	Design Criteria
601	General	I.	Control Valves
612	Well Pumps and Tanks used for Private		
	Potable Water Systems	Part IV	Materials
		H.	Low Voltage Wiring
Chapter 11	Storm Drainage	I.	Irrigation Controllers
1113	Sumps and Pumping Systems	J.	Pumps and Wells
Chapter 13	Referenced Standards	Part V	Installation
		E.	Low Voltage Wire Installation
Appendix F	Proposed Construction Building Codes	F.	Hydraulic Control Tubing
	For Turf and Landscape Irrigation		
	Systems		

(continued)

TABLE 2703—continued
Florida Building Code—Fuel Gas

Section		Section	
Chapter 2	Definitions	Chapter 6	Specific Appliances
		627	Air Conditioning Equipment
Chapter 3	General Regulations	630	Infrared Radiant Heaters
306	Access and Service Space		
309	Electrical	Chapter 7	Gaseous Hydrogen Systems
310	Electrical Bonding	703	General Requirements
		706	Location of Gaseous Hydrogen Systems
Chapter 4	Gas Piping Installations		
413	Compressed Natural Gas Motor Vehicle	Chapter 8	Referenced Standards
	Fuel-Dispensing Stations		

This table is provided only as a tool to assist the construction industry as a general guide. Users should review all sections of the code in order to determine specific applicable electrical requirements.

CHAPTER 28
MECHANICAL SYSTEMS

SECTION 2801
GENERAL

2801.1 Scope. Mechanical appliances, equipment and systems shall be constructed, installed and maintained in accordance with the *Florida Building Code, Mechanical* and the *Florida Building Code, Fuel Gas*. Masonry chimneys, fireplaces and barbecues shall comply with the *Florida Building Code, Mechanical* and Chapter 21 of this code.

CHAPTER 29
PLUMBING SYSTEMS

SECTION 2901
GENERAL

2901.1 Scope. The provisions of this chapter and the *Florida Building Code, Plumbing* shall govern the erection, installation, alteration, repairs, relocation, replacement, addition to, use or maintenance of plumbing equipment and systems. Plumbing systems and equipment shall be constructed, installed and maintained in accordance with the *Florida Building Code, Plumbing.*

SECTION 2902
MINIMUM PLUMBING FACILITIES
RESERVED

CHAPTER 30
ELEVATORS AND CONVEYING SYSTEMS

SECTION 3001
GENERAL

3001.1 Scope. This chapter governs the design, construction, installation, alteration and repair of elevators and conveying systems and their components.

Note: Other administrative and programmatic provisions may apply. See the Department of Business and Professional Regulation [DBPR] Chapter 399, *Florida Statutes*, and 61C-5, *Florida Administrative Code*. The regulation and enforcement of the following sections of the adopted codes, and their addenda, are preempted to the Bureau of Elevator Safety of the Department of Business and Professional regulation: ASME A 17.1, Part 8, ASME A17.3, Sections 1.2, 1.5, ASME A 18.1, Part 10.

3001.2 Referenced standards. Except as otherwise provided for in this code, the design, construction, installation, alteration, repair and maintenance of elevators and conveying systems and their components shall conform to ASME A17.1, ASME A17.1S, ASME A90.1, ASME B20.1, ALI ALCTV, ASME A17.3 and ASME A18.1.

The Division of Hotels and Restaurants may grant exceptions, variances and waivers to the *Elevator Safety Code* as authorized by the *Elevator Safety Code (ASME A 17.1, Section 1.2) and Florida Statutes* (Chapter 120.)

3001.3 Accessibility. Passenger elevators required to be accessible by Chapter 11.

3001.4 Change in use. A change in use of an elevator from freight to passenger, passenger to freight, or from one freight class to another freight class shall comply with Part XII of ASME A17.1.

3001.5 Design, installation and alteration of elevators.

1. Each elevator shall comply with the *Elevator Safety Code* that was in effect at the time of receipt of application for the construction permit for the elevator.
2. Each alteration to, or relocation of, an elevator shall comply with the *Elevator Safety Code* that was in effect at the time of receipt of the application for the construction permit for the alteration or relocation.

3001.6 As used in this chapter, the term:

ALTERATION. Any change or addition to the vertical conveyance other than maintenance, repair or replacement.

CERTIFICATE OF OPERATION means a document issued by the department which indicates that the conveyance has had the required safety inspection and tests and that fees have been paid as provided in Chapter 399, FS.

CONVEYANCE. An elevator, dumbwaiter, escalator, moving sidewalk, platform lift and stairway chairlift.

DEPARTMENT. For the purpose of this section, means the Department of Business and Professional Regulation.

DIVISION. For the purpose of this section, means the Division of Hotels and Restaurants of the Department of Business and Professional Regulation.

ELEVATOR. One of the following mechanical devices:

(a) A hoisting and lowering mechanism, equipped with a car and platform that moves in guide rails and serves two or more landings to transport material or passengers or both.

(b) An escalator, which is a power-driven, inclined continuous stairway used for raising or lowering passengers.

(c) A dumbwaiter, which is a hoisting and lowering mechanism equipped with a car of limited size which moves in guide rails and serves two or more landings.

(d) A moving walk, which is a type of passenger-carrying device on which passengers stand or walk and in which the passenger-carrying surface remains parallel to its direction of motion and is uninterrupted.

(e) An inclined stairway chairlift, which is a device used to transport physically handicapped persons over architectural barriers.

(f) An inclined or vertical wheelchair lift, which is a device used to transport wheelchair handicapped persons over architectural barriers.

Exceptions:

Personnel hoists and material hoists within the scope of ASME A10.

Man lifts within the scope of ASME A90.1.

Mobile scaffolds, towers and platforms within the scope of ANSI A92.

Powered platforms and equipment for exterior and interior maintenance within the scope of ASME A120.1.

Conveyors and related equipment within the scope of ASME B20.1.

Cranes, derricks, hoists, hooks, jacks and slings within the scope of ASME B30.

Industrial trucks within the scope of ASME B56.

Portable equipment, except for portable escalators that are covered by this code.

Tiered or piling machines used to move materials to and from storage located and operating entirely within one story.

Equipment for feeding or positioning materials at machine tools and printing presses.

Skip or furnace hoists.

Wharf ramps.

Railroad car lifts or dumpers.

Line jacks, false cars, shafters, moving platforms and similar equipment used for installing an elevator by a contractor licensed in this state.

Automated people movers at airports.

Elevators in television and radio towers.

Hand-operated dumbwaiters.

Sewage pump station lifts.

Automobile parking lifts.

Equipment covered in Section 1.1.2 of the *Elevator Safety Code*.

Elevators, inclined stairway chairlifts and inclined or vertical wheelchair lifts located in private residences.

ESCALATOR. An installation defined as an escalator in the *Florida Building Code*.

EXISTING INSTALLATION. An installation defined as an "installation, existing" in the *Florida Building Code*.

PRIVATE RESIDENCE. A separate dwelling or a separate apartment in a multiple dwelling which is occupied by members of a single family.

SECTION 3002
HOISTWAY ENCLOSURES

3002.1 Hoistway enclosure protection. Elevator, dumbwaiter and other hoistway enclosures shall be shaft enclosures complying with Section 707.

3002.1.1 Opening protectives. Openings in hoistway enclosures shall be protected as required in Chapter 7.

Exception: The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I Emergency Recall Operation.

3002.1.2 Hardware. Hardware on opening protectives shall be of an approved type installed as tested, except that approved interlocks, mechanical locks and electric contacts, door and gate electric contacts and door-operating mechanisms shall be exempt from the fire test requirements.

3002.2 Number of elevator cars in a hoistway. Where four or more elevator cars serve all or the same portion of a building, the elevators shall be located in at least two separate hoistways. Not more than four elevator cars shall be located in any single hoistway enclosure.

3002.3 Emergency signs. An approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. The sign shall read: IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE EXIT STAIRS. The emergency sign shall not be required for elevators that are part of an accessible means of egress complying with Section 1007.4.

3002.4 Elevator car to accommodate ambulance stretcher. Where elevators are provided in buildings four or more stories above grade plane or four or more stories below grade plane, at least one elevator shall be provided for fire department emergency access to all floors. The elevator car shall be of such a size and arrangement to accommodate a 24-inch by 84-inch (610 mm by 2250 mm) ambulance stretcher in the horizontal, open position and shall be identified by the international symbol for emergency medical services (star of life). The symbol shall not be less than 3 inches (76 mm) high and shall be placed inside on both sides of the hoistway door frame.

3002.5 Emergency doors. Where an elevator is installed in a single blind hoistway or on the outside of a building, there shall be installed in the blind portion of the hoistway or blank face of the building, an emergency door in accordance with ASME A17.1.

3002.6 Prohibited doors. Doors, other than hoistway doors and the elevator car door, shall be prohibited at the point of access to an elevator car unless such doors are readily openable from the car side without a key, tool, special knowledge or effort.

3002.7 Common enclosure with stairway. Elevators shall not be in a common shaft enclosure with a stairway.

3002.8 Glass in elevator enclosures. Glass in elevator enclosures shall comply with Section 2409.1.

3002.9 Automatic fire alarm-initiating devices shall be located and installed in accordance with ASME A17.1 and NFPA 72.

[F] SECTION 3003
EMERGENCY OPERATIONS

[F] 3003.1 Standby power. In buildings and structures where standby power is required or furnished to operate an elevator, the operation shall be in accordance with Sections 3003.1.1 through 3003.1.4.

[F] 3003.1.1 Manual transfer. Standby power shall be manually transferable to all elevators in each bank.

[F] 3003.1.2 One elevator. Where only one elevator is installed, the elevator shall automatically transfer to standby power within 60 seconds after failure of normal power.

[F] 3003.1.3 Two or more elevators. Where two or more elevators are controlled by a common operating system, all elevators shall automatically transfer to standby power within 60 seconds after failure of normal power where the standby power source is of sufficient capacity to operate all elevators at the same time. Where the standby power source is not of sufficient capacity to operate all elevators at the same time, all elevators shall transfer to standby power in sequence, return to the designated landing and disconnect from the standby power source. After all elevators have been returned to the designated level, at least one elevator shall remain operable from the standby power source.

[F] 3003.1.4 Venting. Where standby power is connected to elevators, the machine room ventilation or air conditioning shall be connected to the standby power source.

[F] 3003.2 Fire-fighters' emergency operation. Elevators shall be provided with Phase I emergency recall operation and Phase II emergency in-car operation in accordance with ASME A17.1.

SECTION 3004
HOISTWAY VENTING

3004.1 Vents required. Hoistways of elevators and dumbwaiters penetrating more than three stories shall be provided with a means for venting smoke and hot gases to the outer air in case of fire.

Exceptions:

1. In occupancies of other than Groups R-1, R-2, I-1, I-2 and similar occupancies with overnight sleeping quarters, venting of hoistways is not required where the building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Sidewalk elevator hoistways are not required to be vented.

3004.2 Location of vents. Vents shall be located at the top of the hoistway and shall open either directly to the outer air or through noncombustible ducts to the outer air. Noncombustible ducts shall be permitted to pass through the elevator machine room, provided that portions of the ducts located outside the hoistway or machine room are enclosed by construction having not less than the fire protection rating required for the hoistway. Holes in the machine room floors for the passage of ropes, cables or other moving elevator equipment shall be limited so as not to provide greater than 2 inches (51 mm) of clearance on all sides.

3004.3 Area of vents. Except as provided for in Section 3004.3.1, the area of the vents shall not be less than $3^1/_2$ percent of the area of the hoistway nor less than 3 square feet (0.28 m^2) for each elevator car, and not less than $3^1/_2$ percent nor less than 0.5 square feet (0.047 m^2) for each dumbwaiter car in the hoistway, whichever is greater. Of the total required vent area, not less than one-third shall be permanently open. Closed portions of the required vent area shall consist of openings glazed with annealed glass not greater than 0.125 inch (3.2 mm) in thickness.

Exception: The total required vent area shall not be required to be permanently open where all the vent openings automatically open upon detection of smoke in the elevator lobbies or hoistway, upon power failure and upon activation of a manual override control.

3004.3.1 Reduced vent area. Where mechanical ventilation conforming to the *Florida Building Code, Mechanical* is provided, a reduction in the required vent area is allowed provided that all of the following conditions are met:

1. The occupancy is not in Group R-1, R-2, I-1 or I-2 or of a similar occupancy with overnight sleeping quarters.
2. The vents required by Section 3004.2 do not have outside exposure.
3. The hoistway does not extend to the top of the building.
4. The hoistway and machine room exhaust fan is automatically reactivated by thermostatic means.
5. Equivalent venting of the hoistway is accomplished.

3004.4 Plumbing and mechanical systems. Plumbing and mechanical systems shall not be located in an elevator shaft.

Exception: Floor drains, sumps and sump pumps shall be permitted at the base of the shaft provided they are indirectly connected to the plumbing system.

SECTION 3005
CONVEYING SYSTEMS

3005.1 General. Escalators, moving walks, conveyors, personnel hoists and material hoists shall comply with the provisions of this section.

3005.2 Escalators and moving walks. Escalators and moving walks shall be constructed of approved noncombustible and fire-retardant materials. This requirement shall not apply to electrical equipment, wiring, wheels, handrails and the use of $^1/_{28}$-inch (0.9 mm) wood veneers on balustrades backed up with noncombustible materials.

3005.2.1 Enclosure. Escalator floor openings shall be enclosed with shaft enclosures complying with Section 707.

3005.2.2 Escalators. Where provided in below-grade transportation stations, escalators shall have a clear width of 32 inches (815 mm) minimum.

Exception: The clear width is not required in existing facilities undergoing alterations.

3005.3 Conveyors. Conveyors and conveying systems shall comply with ASME B20.1.

3005.3.1 Enclosure. Conveyors and related equipment connecting successive floors or levels shall be enclosed with shaft enclosures complying with Section 707.

3005.3.2 Conveyor safeties. Power-operated conveyors, belts and other material-moving devices shall be equipped with automatic limit switches which will shut off the power in an emergency and automatically stop all operation of the device.

3005.4 Personnel and material hoists. Personnel and material hoists shall be designed utilizing an approved method that accounts for the conditions imposed during the intended operation of the hoist device. The design shall include, but is not limited to, anticipated loads, structural stability, impact, vibration, and stresses. The design shall account for the construction, installation, operation and inspection of the hoist tower, car, machinery and control equipment, guide members and hoisting mechanism. Additionally, the design of personnel hoists shall include provisions for field testing and maintenance which will demonstrate that the hoist device functions in accordance with the design. Field tests shall be conducted upon the completion

of an installation or following a major alteration of a personnel hoist.

SECTION 3006
MACHINE ROOMS

3006.1 Access. An approved means of access shall be provided to elevator machine rooms and overhead machinery spaces.

3006.2 Venting. Elevator machine rooms that contain solid-state equipment for elevator operation shall be provided with an independent ventilation or air-conditioning system to protect against the overheating of the electrical equipment. The system shall be capable of maintaining temperatures within the range established for the elevator equipment.

3006.3 Pressurization. The elevator machine room serving a pressurized elevator hoistway shall be pressurized upon activation of a heat or smoke detector located in the elevator machine room.

3006.4 Machine rooms and machinery spaces. Elevator machine rooms and machinery spaces shall be enclosed with fire barriers complying with Section 706 or horizontal assemblies complying with Section 711 having a fire-resistance rating not less than the required rating of the hoistway enclosure served by the machinery. Openings shall be protected with assemblies having a fire-protection rating not less than that required for the hoistway enclosure doors.

3006.5 Shunt trip. Where elevator hoistways or elevator machine rooms containing elevator control equipment are protected with automatic sprinklers, a means installed in accordance with NFPA 72, Section 3-9.4, Elevator Shutdown, shall be provided to disconnect automatically the main line power supply to the affected elevator prior to the application of water. This means shall not be self-resetting. The activation of sprinklers outside the hoistway or machine room shall not disconnect the main line power supply.

3006.6 Plumbing systems. Plumbing systems shall not be located in elevator equipment rooms.

SECTION 3007
ELEVATOR ACCESSIBILITY REQUIREMENTS FOR THE PHYSICALLY HANDICAPPED

3007.1 Each elevator must be made accessible to physically handicapped persons with the following requirements:

1. In a building having any elevators that do not provide access to every floor level, elevator hallway call buttons on all main levels of ingress and on any floor that is commonly served by more than one group of elevators must be marked with Arabic numerals and braille symbols that indicate floor levels to which access is provided. The symbols must be placed directly above each call button.
2. Each elevator car interior must have a support rail on at least one wall. All support rails must be smooth and have no sharp edges and must not be more than 1½ inches (38 mm) thick or 2½ inches (63 mm) in diameter. Support rails must be continuous and a minimum length of 42 inches (1067 mm) overall.

   The inside surface of support rails must be 1½ inches (38 mm) clear of the car wall. The distance from the top of the support rail to the finished car floor must be at least 31 inches (787 mm) and not more than 33 inches (838 mm). Padded or tufted material or decorative materials such as wallpaper, vinyl, cloth or the like may be not be used on support rails.
3. A bench or seat may be installed on the rear wall of the elevator car enclosure, if the bench or seat does not protrude beyond the vertical plane of the elevator car enclosure wall when folded into a recess provided for the bench or seat and, when not in use, the bench or seat automatically folds into the recess. The bench or seat must be capable of supporting a live load of at least 250 pounds (113.4 kg) on any 12-inch by 12-inch (305 mm by 305 mm) area. A padded, tufted or other decorative material may not be used to cover the bench or seat; nor may the bench or seat encroach on the minimum clear inside-car dimensions specified in this section.

This section applies only to elevators available for the transportation of the public. This section does not apply to elevators restricted by key or similar device to a limited number of persons in a building that has an elevator that otherwise meets the requirements of this section or to elevators used only for the transportation of freight. However, elevators that are used as freight and passenger elevators for the public and employees must comply with this section. This section does not apply to dumbwaiters or escalators.

This section supersedes all other state regulations and local ordinances and rules affecting the accessibility of passenger elevators to the physically handicapped, and the standards established by this section may not be modified by municipal or county ordinance.

SECTION 3008
SERIAL NUMBERS

3008.1 Serial numbers. Each elevator shall have a serial number assigned by the division painted on or attached to the elevator car in plain view and also to the driving mechanism. This serial number shall be shown on all required certificates and permits.

1. Certificates of operation must be posted in a conspicuous location in the elevator and shall contain the text of Section 823.12, *Florida Statutes* relating to the prohibition against smoking in elevators. The certificate must be framed with a transparent cover.
2. In addition to Item 3, the designation "NO SMOKING" along with the international symbol for no smoking shall be conspicuously displayed within the interior of the elevator in the plain view of the public.
3. The following rules of ASME A17.1, are hereby amended to read as follows:
   a. Rule 2.29.1 is to have the following sentence added at the end of this rule: Each car in a multi-car group shall be sequentially identified from left to right, as viewed from the elevator lobby.

b. Rule 2.7.3.1 of ASME A17.1, which is amended to read as follows: "Rule 2.7.3.1 General Requirements. A permanent, safe and convenient means of access to elevator machine rooms and overhead machinery spaces shall be provided for authorized persons. The key to the machine rooms and overhead machinery spaces shall be kept on the premises at all times and readily available for use by State of Florida certified Elevator Inspectors."

c. Rule 2.27.8, Switch Keys, of ASME A17.1, is amended to read as follows: "The switches required by Rule 211.2 through 211.5, for all elevators in a building, must be operable by the same keys. This key must not be part of a building master key system. There must be a key for the designated level switch and for each elevator in the group. These keys must be kept on the premises at all times in a location readily accessible to authorized personnel, and state elevator inspectors, but not where the key is available to the general public. NOTE: (RULE 2.27.8): Local authorities may specify a uniform keyed lock box to contain the necessary keys."

d. Rule 6.1.6.1, Starting Switch, of ASME A17.1, is amended to read as follows: "Starting switches must be of the key-operated type and must be located so that the escalator steps are within sight. Automatic starting by any means is prohibited. The key for the starting switches must be kept on the premises at all times in a location readily available to authorized personnel and state elevator inspectors, but not where the key is available to the general public."

e. Rule 2.2.2.4 Drains connected directly to sewers shall not be installed in elevator pits. Where drains are not provided to prevent the accumulation of water, a sump of adequate size and depth to accommodate a pump shall be provided, with or without a pump.

SECTION 3009
ELECTROLYSIS PROTECTION FOR UNDERGROUND HYDRAULIC ELEVATOR CYLINDERS

3009.1 Electrolysis protection for underground hydraulic elevator cylinders. All newly installed underground hydraulic pressure cylinders shall be encased in outer plastic containment to minimize electrolytic corrosion between the metal cylinder and ground cathode.

1. The plastic casing shall be capped at the bottom, and all joints must be solvent or heat welded to ensure water tightness.
2. The plastic casing shall be constructed of polyethylene or polyvinyl chloride (PVC). The plastic pipe wall thickness must not be less than 0.125 inch (3.175 mm).
3. The neck of the plastic casing shall have a means of inspection provided to monitor the annulus between the pressurized hydraulic cylinder and the protective plastic casing.
4. Replacements of existing hydraulic cylinders shall be protected by the aforementioned method where existing physical dimensions permit.

SECTION 3010
BULLETIN BOARDS

3010.1 Bulletin boards.

1. Bulletin boards and frames used in elevator cars shall not create any conditions which will be unsafe for users of the elevator car. Users shall include:
   A. Disabled persons;
   B. Persons confined to wheelchairs; and
   C. All other persons who may operate the elevator car in its normal course of use.
2. Bulletin boards shall not protrude more than 1 inch (25.4 mm) beyond the vertical line of the car wall. They shall not encroach on any clearances required to be maintained in the elevator by Chapter 399, *Florida Statutes*, and ASME A17.1.
3. Bulletin boards shall be framed and all edges must be smooth and rounded. No sharp edges of any kind shall protrude.
4. A glass or plastic cover shall be provided. Glass, if used, must meet the following requirements:
   A. Be laminated;
   B. Meet the requirement for laminated glass as set forth in ANSI Z97.1;
   C. The cover shall be securely held in place by the frame.
5. The frame and bulletin board shall be permanently fastened to the car wall in such a manner that all parts including the cover in place will withstand any and all tests required of the elevator.
6. All materials used shall be fire resistive equal to the requirements of the cab enclosure.
7. The bottom of the bulletin boards shall not be less than 5 feet (1524 mm) above the cab floor, and the total area shall not exceed 4 square feet (0.37 m^2).

SECTION 3011
ALTERATIONS TO ELECTRIC AND HYDRAULIC ELEVATORS AND ESCALATORS

3011.1 Alterations to electric and hydraulic elevators and escalators.

1. In addition to the alterations set forth in Rule 8.10.3.3.2 and Rule 8.10.2.3.2 ASME A17.1, the following alterations require, in addition to a construction permit, that inspections and tests be performed to determine conformance with ASME A17.1, rules cited below:

ALTERATIONS	Electric Elevators	Hydraulic Elevators
(a) Addition of elevator to existing hoistway (new installation)	8.7.2.1.2	8.7.2.1.2
(b) Brake (replacements of existing drive, machine brake by a new brake)	2.24	—
(c) Buffer (addition of oil buffer)	9.7.2.23	8.7.2.27
(d) Driving machine (replacement of)	8.7.2.25.1	8.7.3.23
(e) Freight elevator converted to passenger service	8.7.2.16.1	8.7.3.27
(f) Rope, replacement in size or number of ropes	8.6.2.5	8.6.2.5
(g) Sheave, driving machine (replacement in size)	8.7.2.25.1	8.7.2.25.1

2. The following alterations require, in addition to a construction permit, that inspections be performed to determine conformance with ASME A17.1, rule cited below:

ALTERATIONS	Electric Elevators	Hydraulic Elevators
(a) Access Switch (addition of)	8.7.2.11.4, 8.7.7.2	8.7.3.11, 8.7.7.2
(b) Automatic transfer device (addition of)		8.7.3.13
(c) Car, door or gate (addition of car door or gate electric contacts)	8.7.2.14	
(d) Car enclosure	8.7.2.14	8.7.3.13
(e) Car leveling device (addition of) and (trucking device)	8.7.2.27.2	8.7.3.31.2
(f) Control	8.7.2.27.5	8.7.3.31.6
(g) Control equipment	8.7.2.27	8.7.3.31
(h) Controller (existing controller w/new) (excluding dispatching device)	8.7.2.27.4	8.7.3.31.5
(i) Counterweight (change of)	8.7.3.23	8.7.3.26
(j) Increase in travel (or decrease)	8.7.2.17.1	8.7.3.22.1
(k) Door, hoistway (replacement of all hoistway doors)	8.7.2.10	8.7.3.10
(l) Escalator, relocation of	8.7.6.1	—
(m) Escalator, skirt (switches addition of safety device)	6.1.6	—
(n) Freight elevator permitted to carry passengers	8.7.2.16.3	8.7.3.19
(o) Guide rails (change in type or size)	8.7.2.24	8.7.3.28
(p) Hoistway door, power operation of (addition of)	8.7.2.12	8.7.3.12
(q) Hoistway door locking device (addition of)	8.7.2.11	8.7.3.11
(r) Operation, change in type of	8.7.2.27.6	8.7.3.31.7
(s) Platform, car (complete replacement of)	8.7.2.15.1	8.7.3.14
(t) Roller guide shoe, counter-weight and car (addition of)	8.7.2.22	8.7.2.22
(u) Rope equalizer (addition of)	8.7.2.21.2	8.7.3.25.2
(v) Rope fastening device, auxiliary (addition of)	8.7.2.21.3	8.7.2.21.3
(w) Tank (replacement of) (with different capacity)	—	8.7.3.29
(x) Top of car operating device (addition of)	8.7.2.27.1	8.7.3.31.1

CHAPTER 31
SPECIAL CONSTRUCTION

SECTION 3101
GENERAL

3101.1 Scope. The provisions of this chapter shall govern special building construction including membrane structures, temporary structures, pedestrian walkways and tunnels, awnings and canopies, marquees, signs, and towers and antennas.

SECTION 3102
MEMBRANE STRUCTURES

3102.1 General. The provisions of this section shall apply to air-supported, air-inflated, membrane-covered cable and membrane-covered frame structures, collectively known as membrane structures, erected for a period of 180 days or longer. Those erected for a shorter period of time shall comply with the *Florida Fire Prevention Code.* Membrane structures covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants, greenhouses and similar facilities not used for human occupancy, are required to meet only the requirements of Sections 3102.3.1 and 3102.7.

3102.2 Definitions. The following words and terms shall, for the purposes of this section and as used elsewhere in this code, have the meanings shown herein:

AIR-INFLATED STRUCTURE. A building where the shape of the structure is maintained by air pressurization of cells or tubes to form a barrel vault over the usable area. Occupants of such a structure do not occupy the pressurized area used to support the structure.

AIR-SUPPORTED STRUCTURE. A building wherein the shape of the structure is attained by air pressure and occupants of the structure are within the elevated pressure area. Air-supported structures are of two basic types:

Double skin. Similar to a single skin, but with an attached liner that is separated from the outer skin and provides an airspace which serves for insulation, acoustic, aesthetic or similar purposes.

Single skin. Where there is only the single outer skin and the air pressure is directly against that skin.

CABLE-RESTRAINED, AIR-SUPPORTED STRUCTURE. A structure in which the uplift is resisted by cables or webbings which are anchored to either foundations or dead men. Reinforcing cable or webbing is attached by various methods to the membrane or is an integral part of the membrane. This is not a cable-supported structure.

MEMBRANE-COVERED CABLE STRUCTURE. A nonpressurized structure in which a mast and cable system provides support and tension to the membrane weather barrier and the membrane imparts stability to the structure.

MEMBRANE-COVERED FRAME STRUCTURE. A nonpressurized building wherein the structure is composed of a rigid framework to support a tensioned membrane which provides the weather barrier.

NONCOMBUSTIBLE MEMBRANE STRUCTURE. A membrane structure in which the membrane and all component parts of the structure are noncombustible.

3102.3 Type of construction. Noncombustible membrane structures shall be classified as Type IIB construction. Noncombustible frame or cable-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IIB construction. Heavy timber frame-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IV construction. Other membrane structures shall be classified as Type V construction.

Exception: Plastic less than 30 feet (9144 mm) above any floor used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of NFPA 701.

3102.3.1 Membrane and interior liner material. Membranes and interior liners shall be either noncombustible as set forth in Section 703.4 or meet the fire propagation performance criteria of NFPA 701 and the manufacturer's test protocol.

Exception: Plastic less than 20 mil (0.5 mm) in thickness used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of NFPA 701.

3102.4 Allowable floor areas. The area of a membrane structure shall not exceed the limitations set forth in Table 503, except as provided in Section 506.

3102.5 Maximum height. Membrane structures shall not exceed one story nor shall such structures exceed the height limitations in feet set forth in Table 503.

Exception: Noncombustible membrane structures serving as roofs only.

3102.6 Mixed construction. Membrane structures shall be permitted to be utilized as specified in this section as a portion of buildings of other types of construction. Height and area limits shall be as specified for the type of construction and occupancy of the building.

3102.6.1 Noncombustible membrane. A noncombustible membrane shall be permitted for use as the roof or as a skylight of any building or atrium of a building of any type of construction provided it is at least 20 feet (6096 mm) above any floor, balcony or gallery.

3102.6.1.1 Membrane. A membrane meeting the fire propagation performance criteria of NFPA 701 shall be permitted to be used as the roof or as a skylight on build-

ings of Type IIB, III, IV and V construction, provided it is at least 20 feet (6096 mm) above any floor, balcony or gallery.

3102.7 Engineering design. The structure shall be designed and constructed to sustain dead loads; loads due to tension or inflation; live loads including wind loads in accordance with Chapter 16.

3102.8 Inflation systems. Air-supported and air-inflated structures shall be provided with primary and auxiliary inflation systems to meet the minimum requirements of Sections 3102.8.1 through 3102.8.3.

3102.8.1 Equipment requirements. This inflation system shall consist of one or more blowers and shall include provisions for automatic control to maintain the required inflation pressures. The system shall be so designed as to prevent overpressurization of the system.

3102.8.1.1 Auxiliary inflation system. In addition to the primary inflation system, in buildings exceeding 1,500 square feet (140 m^2) in area, an auxiliary inflation system shall be provided with sufficient capacity to maintain the inflation of the structure in case of primary system failure. The auxiliary inflation system shall operate automatically when there is a loss of internal pressure and when the primary blower system becomes inoperative.

3102.8.1.2 Blower equipment. Blower equipment shall meet the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required for any flow condition as required by the structural design.
2. Blowers shall be provided with inlet screens, belt guards and other protective devices as required by the building official to provide protection from injury.
3. Blowers shall be housed within a weather-protecting structure.
4. Blowers shall be equipped with backdraft check dampers to minimize air loss when inoperative.
5. Blower inlets shall be located to provide protection from air contamination. The location of inlets shall be approved.

3102.8.2 Standby power. Wherever an auxiliary inflation system is required, an approved standby power-generating system shall be provided. The system shall be equipped with a suitable means for automatically starting the generator set upon failure of the normal electrical service and for automatic transfer and operation of all of the required electrical functions at full power within 60 seconds of such service failure. Standby power shall be capable of operating independently for a minimum of 4 hours.

3102.8.3 Support provisions. A system capable of supporting the membrane in the event of deflation shall be provided for in air-supported and air-inflated structures having an occupant load of 50 or more or where covering a swimming pool regardless of occupant load. The support system shall be capable of maintaining membrane structures used as a roof for Type I construction not less than 20 feet (6096 mm) above floor or seating areas. The support system shall be capable of maintaining other membranes at least 7 feet (2134 mm) above the floor, seating area or surface of the water.

SECTION 3103
TEMPORARY STRUCTURES

3103.1 General. The provisions of this section shall apply to structures erected for a period of less than 180 days. Tents and other membrane structures erected for a period of less than 180 days shall comply with the *Florida Fire Prevention Code*. Those erected for a longer period of time shall comply with applicable sections of this code.

Exception: Provisions of the *Florida Fire Prevention Code* shall apply to tents and membrane structures erected for a period of less than 180 days.

3103.1.1 Permit required. Temporary structures that cover an area in excess of 120 square feet (11.16 m^2), including connecting areas or spaces with a common means of egress or entrance which are used or intended to be used for the gathering together of 10 or more persons, shall not be erected, operated or maintained for any purpose without obtaining a permit from the building official.

3103.2 Construction documents. A permit application and construction documents shall be submitted for each installation of a temporary structure. The construction documents shall include a site plan indicating the location of the temporary structure and information delineating the means of egress and the occupant load.

3103.3 Location. Temporary structures shall be located in accordance with the requirements of Table 602 based on the fire-resistance rating of the exterior walls for the proposed type of construction.

3103.4 Means of egress. Temporary structures shall conform to the means of egress requirements of Chapter 10 and shall have a maximum exit access travel distance of 100 feet (30 480 mm).

SECTION 3104
PEDESTRIAN WALKWAYS AND TUNNELS

3104.1 General. This section shall apply to connections between buildings such as pedestrian walkways or tunnels, located at, above or below grade level, that are used as a means of travel by persons. The pedestrian walkway shall not contribute to the building area or the number of stories or height of connected buildings.

3104.2 Separate structures. Connected buildings shall be considered to be separate structures.

Exceptions:

1. Buildings on the same lot in accordance with Section 503.1.2.
2. For purposes of calculating the number of Type B units required by Chapter 11, structurally connected

buildings and buildings with multiple wings shall be considered one structure.

3104.3 Construction. The pedestrian walkway shall be of noncombustible construction.

Exceptions:

1. Combustible construction shall be permitted where connected buildings are of combustible construction.
2. Fire-retardant-treated wood, in accordance with Section 603.1, Item 1.3, shall be permitted for the roof construction of the pedestrian walkway where connected buildings are a minimum of Type I or II construction.

3104.4 Contents. Only materials and decorations approved by the building official shall be located in the pedestrian walkway.

3104.5 Fire barriers between pedestrian walkways and buildings. Walkways shall be separated from the interior of the building by fire-barrier walls with a fire-resistance rating of not less than 2 hours. This protection shall extend vertically from a point 10 feet (3048 mm) above the walkway roof surface or the connected building roof line, whichever is lower, down to a point 10 feet (3048 mm) below the walkway and horizontally 10 feet (3048 mm) from each side of the pedestrian walkway. Openings within the l0-foot (3048 mm) horizontal extension of the protected walls beyond the walkway shall be equipped with devices providing a $^{3}/_{4}$-hour fire protection rating in accordance with Section 715.

Exception: The walls separating the pedestrian walkway from a connected building are not required to have a fire-resistance rating by this section where any of the following conditions exist:

1. The distance between the connected buildings is more than 10 feet (3048 mm), the pedestrian walkway and connected buildings, except for open parking garages, are equipped throughout with an automatic sprinkler system in accordance with NFPA 13 and the wall is constructed of a tempered, wired or laminated glass wall and doors subject to the following:
   1.1. The glass shall be protected by an automatic sprinkler system in accordance with NFPA 13 and the sprinkler system shall completely wet the entire surface of interior sides of the glass wall when actuated.
   1.2. The glass shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler operates.
   1.3. Obstructions shall not be installed between the sprinkler heads and the glass.
2. The distance between the connected buildings is more than 10 feet (3048 mm) and both sidewalls of the pedestrian walkway are at least 50 percent open with the open area uniformly distributed to prevent the accumulation of smoke and toxic gases.
3. Buildings are on the same lot in accordance with Section 503.1.2.
4. Where exterior walls of connected buildings are required by Section 704 to have a fire-resistance rating greater than 2 hours, the walkway shall be equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

The previous exceptions shall apply to the pedestrian walkways that have a maximum height above grade of three stories or 40 feet (12 192 mm), or five stories or 55 feet (16 764 mm) where sprinklered.

3104.6 Public way. Pedestrian walkways over a public way shall also comply with Chapter 32.

3104.7 Egress. Access shall be provided at all times to a pedestrian walkway that serves as a required exit.

3104.8 Width. The unobstructed width of pedestrian walkways shall not be less than 36 inches (914 mm). The total width shall not exceed 30 feet (9144 mm).

3104.9 Exit access travel. The length of exit access travel shall not exceed 200 feet (60 960 mm).

Exceptions:

1. Exit access travel distance on a pedestrian walkway equipped throughout with an automatic sprinkler system in accordance with NFPA 13 shall not exceed 250 feet (76 200 mm).
2. Exit access travel distance on a pedestrian walkway constructed with both sides at least 50 percent open shall not exceed 300 feet (91 440 mm).
3. Exit access travel distance on a pedestrian walkway constructed with both sides at least 50 percent open, and equipped throughout with an automatic sprinkler system in accordance with NFPA 13, shall not exceed 400 feet (122 m).

3104.10 Tunneled walkway. Separation between the tunneled walkway and the building to which it is connected shall not be less than 2-hour fire-resistant construction and openings therein shall be protected in accordance with Table 715.4.

SECTION 3105
AWNINGS AND CANOPIES

3105.1 Fabric awnings and fabric-covered frames. Fabric awnings and fabric-covered frames shall comply with the provisions of Section 3105 as applicable.

3105.1.1 Location.

3105.1.1.1 Fabric awnings and fabric-covered frames located over public property or in areas accessible to the general public shall be constructed so that no rigid part of such fabric awnings or fabric-covered frames shall be less than 7 feet, 6 inches (2286 mm) from the grade directly below, and no part of the cloth drop shall be less than 7 feet (2134 mm).

3105.1.1.2 A fixed fabric awning or fabric-covered frame shall not extend over public property more than two-thirds the distance from the property line to the nearest curb line in front of the building site as measured from

the exterior face of the building nor shall any portion be closer than 18 inches (457 mm) to the curb line.

Exceptions:

1. If installed over 14 feet (4267 mm) in height, it may occupy the entire width of the sidewalk.
2. Unless otherwise regulated by local zoning requirements.

3105.1.1.3 Fabric-covered framework in whole or in part of fabric, erected in connection with gasoline service stations may not be erected within 15 feet (4572 mm) of where flammable liquids are transferred.

3105.1.1.4 Movable fabric awnings or fabric covered frames may extend over public property for a distance of not more than 5 feet (1524 mm), provided such awnings or any part thereof maintain a clear height of 8 feet (2438 mm) above the sidewalk. All such movable awnings shall be supported on metal frames attached to the building.

3105.1.1.5 Every fabric awning or fabric-covered frame shall be located not to interfere with the operation of any exterior standpipe, stairway, fire escape or any means of egress to and from the building.

3105.2 Area. No fabric awning or fabric-covered frame shall exceed the area of the building to which it is attached.

3105.3 Material.

3105.3.1 Fabric used for awnings or fabric-covered frames shall be flame resistant in accordance with NFPA 701.

Exception: Awnings or fabric-covered frames used in conjunction with Group R-3 occupancies.

3105.3.2 Supports for fabric awnings and fabric-covered frame shall be of metal or similar durable material.

3105.4 Design.

3105.4.1 Design of the framing members shall not be based on removal or repositioning of parts, or the whole, during periods of 75 mph wind velocity.

3105.4.2 Design of the structural framing members shall be based on rational analysis, using the applicable wind loads of Chapter 16 as shown below:

3105.4.2.1 The wind design loads for any fabric or membrane-covered structure designed with a quick removal or breakaway membrane or fabric at wind velocities of 75 mph, shall be based on the following criteria:

1. Minimum wind velocity of 3-second wind gust 90 mph
2. Importance factor based on low hazard to human life of 0.77.
3. Exposure Category B for or C as defined in Chapter 16.

3105.4.2.2 The wind design loads for any fabric or membrane covered structure designed with a permanent or nonremovable fabric or membrane, shall be based on the following criteria:

1. Minimum wind velocity as required in Chapter 16.
2. Importance factor based on low hazard to human life of 0.77.
3. Exposure Category B or C as defined in Chapter 16.

3105.4.3 The fabric portions of awnings fabric covered frames shall be securely laced, tied or otherwise fastened to the frame; no rafter or front bar will be permitted in pockets; and in no case shall a rolling curtain be caused to operate over a canopy frame.

3105.4.4 The horizontal projection of cantilevered portions shall not be greater than two times the height, except where the building construction does not permit a proper installation; in which case, variance may be permitted by the building official, based on special design and construction.

3105.5 Rigid awnings and canopy shutters.

3105.5.1 Loads. Rigid awnings and canopy shutters shall be designed to resist the loads set forth in Chapter 16 of this Code except that structures or parts thereof which are intended to be removed or repositioned during periods of high wind velocity shall be designed in their open or extended position to design pressures based on a basic wind speed of minimum 90 mph, 3-second wind gust with applicable shape factors and to resist not less than 10 psf (478 Pa) roof live load.

3105.5.2 Where such structure is intended to be folded or otherwise repositioned to close an opening when the building is unattended or act as a storm shutter, the design in the closed position shall also comply with Chapter 16 and shall be impact resistant in accordance with Section1609.1.4.

3105.5.3 Structures designed to be readily removed or repositioned during periods of high wind velocity shall be posted with a legible and readily visible decal or painted instructions to the owner or tenant to remove or reposition the structure or part thereof during such periods of time as are designated by the U.S. Weather Bureau as being a hurricane warning or alert.

SECTION 3106
MARQUEES

3106.1 General. Marquees shall comply with this section and other applicable sections of this code.

3106.2 Thickness. The maximum height or thickness of a marquee measured vertically from its lowest to its highest point shall not exceed 3 feet (914 mm) where the marquee projects more than two-thirds of the distance from the property line to the curb line, and shall not exceed 9 feet (2743 mm) where the marquee is less than two-thirds of the distance from the property line to the curb line.

3106.3 Roof construction. Where the roof or any part thereof is a skylight, the skylight shall comply with the requirements of Chapter 24. Every roof and skylight of a marquee shall be sloped to downspouts that shall conduct any drainage from the marquee in such a manner so as not to spill over the sidewalk.

3106.4 Location prohibited. Every marquee shall be so located as not to interfere with the operation of any exterior

standpipe, and such that the marquee does not obstruct the clear passage of stairways or exit discharge from the building or the installation or maintenance of street lighting.

3106.5 Construction. A marquee shall be supported entirely from the building and constructed of noncombustible materials. Marquees shall be designed as required in Chapter 16. Structural members shall be protected to prevent deterioration.

SECTION 3107
SIGNS

3107.1 General. Signs shall be designed, constructed and maintained in accordance with this code.

SECTION 3108
RADIO AND TELEVISION TOWERS

3108.1 General. Subject to the provisions of Chapter 16 and the requirements of Chapter 15 governing the fire-resistance ratings of buildings for the support of roof structures, radio and television towers shall be designed and constructed as herein provided.

3108.2 Location and access. Towers shall be located and equipped with step bolts and ladders so as to provide ready access for inspection purposes. Guy wires or other accessories shall not cross or encroach upon any street or other public space, or over above-ground electric utility lines, or encroach upon any privately owned property without written consent of the owner of the encroached-upon property, space or above-ground electric utility lines.

3108.3 Construction. Towers shall be constructed of approved corrosion-resistant noncombustible material. The minimum type of construction of isolated radio towers not more than 100 feet (30 480 mm) in height shall be Type IIB.

3108.4 Loads. Towers shall be designed to resist wind loads in accordance with TIA/EIA-222. Consideration shall be given to conditions involving wind load on ice-covered sections in localities subject to sustained freezing temperatures.

3108.4.1 Dead load. Towers shall be designed for the dead load plus the ice load in regions where ice formation occurs.

3108.4.2 Wind load. Adequate foundations and anchorage shall be provided to resist two times the calculated wind load.

3108.5 Grounding. Towers shall be permanently and effectively grounded.

SECTION 3109
STRUCTURES SEAWARD OF A COASTAL CONSTRUCTION CONTROL LINE

3109.1 General.

3109.1.1 Scope. The provisions of Section 3109 shall ensure that structures located seaward of the coastal construction control line are designed to resist the predicted forces associated with a 100-year storm event and shall apply to the following:

1. All habitable structures which extend wholly or partially seaward of a coastal construction control line (CCCL) or 50-foot (15.3 m) setback line.
2. Substantial improvement of or additions to existing habitable structures.
3. Swimming pools that are located in close proximity to a habitable structure or armoring. An environmental permit from the Florida Department of Environmental Protection, requiring special siting considerations to protect the beach-dune system or proposed or existing structures and public beach access, is required prior to the start of construction. The environmental permit may condition the nature, timing and sequence of construction of permitted activities to provide protection to nesting sea turtles and hatchlings and their habitat, including review, submittal and approval of lighting plans.

   Exception: The standards for buildings seaward of a CCCL area do not apply to any modification, maintenance or repair to any existing structure within the limits of the existing foundation which does not require, involve or include any additions to, or repair or modification of, the existing foundation of that structure.

3109.1.2 Certification. As part of the permit process and upon placement of the lowest horizontal structural member, the applicant shall submit to the building official certification of the elevation of the lowest horizontal structural member of the lowest floor as built in relation to National Geodetic Vertical Datum (N.G.V.D.). Said certification shall be prepared by or under the direct supervision of a registered land surveyor or professional engineer or architect and certified by same and be submitted prior to commencing any addition work. Any work undertaken prior to submission of the certification shall be at the applicant's risk. The building official shall review the submitted elevation data, and any deficiencies found shall be corrected by the permit holder immediately and prior to any further work being permitted to proceed.

3109.2 Definitions.

ARMORING. A manmade structure designed to either prevent erosion of the upland property or protect upland structures from the effects of coastal wave and current action. Armoring includes certain rigid coastal structures such as geotextile bags or tubes, seawalls, revetments, bulkheads, retaining walls or similar structures, but does not include jetties, groins or other construction whose purpose is to add sand to the beach and dune system, alter the natural coastal currents or stabilize the mouths of inlets.

BREAKAWAY WALL. A partition independent of supporting structural members that is intended to withstand design wind forces but to collapse from a water load less than that which would occur during a 100-year storm event without causing

collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system.

COASTAL CONSTRUCTION CONTROL LINE. The line established by the State of Florida pursuant to Section161.053, *Florida Statutes*, and recorded in the official records of the county which defines that portion of the beach-dune system subject to severe fluctuations based on a 100-year storm surge, storm waves or other predictable weather conditions.

DESIGN GRADE. The predicted eroded grade caused by the 100-year storm.

FIFTY-FOOT SETBACK LINE. A line of jurisdiction, established pursuant to the provisions of Section 161.052, *Florida Statutes*, in which construction is prohibited within 50 feet (15.13 m) of the line of mean high water at any riparian coastal location fronting the Gulf of Mexico or the Atlantic coast shoreline.

HABITABLE STRUCTURE. Structures designed primarily for human occupancy and are potential locations for shelter from storms. Typically included within this category are residences, hotels and restaurants.

LOWEST HORIZONTAL STRUCTURE MEMBER. Any shore-parallel structural member which supports floor, wall or column loads and transmits them to the pile foundation.

ONE-HUNDRED-YEAR STORM ELEVATION. The height of the breaking wave crest or wave approach as superimposed on the storm surge with dynamic wave setup of a 100-year storm. This 100-year storm elevation is determined by the Florida Department of Environmental Protection based on studies published as part of the coastal construction control line establishment process and an analysis of topographic and other site specific data.

REBUILDING. See definition of "Substantial improvement."

SUBSTANTIAL IMPROVEMENT. See definition in Section 161.54(12), *Florida Statutes*.

3109.3 Elevation standards. All habitable structures shall be elevated at or above an elevation which places the lowest horizontal structural member above the 100-year storm elevation as determined by the Florida Department of Environmental Protection in the report titled "One-Hundred-Year Storm Elevation Requirements for Habitable Structures Located Seaward of a Coastal Construction Control Line."

An applicant may request the Department of Environmental Protection to determine a site-specific 100-year storm elevation for the applicant's proposed habitable structure as part of the environmental permit application process. The elevation will be provided as part of the applicant's environmental permit and shall be subject to review under the provisions of Chapter 120, *Florida Statutes*.

Exceptions:

1. Additions, repairs or modifications to existing nonconforming habitable structures that do not advance the seaward limits of the existing habitable structure and do not constitute rebuilding of the existing structure.
2. Habitable structures located landward of existing armoring which is capable of protecting buildings from the effects of erosion from a 100-year storm surge. The applicant shall provide scientific and engineering evidence that the armoring has been designed, constructed and maintained to survive the effects of the design storm and provide protection to existing and proposed structures from the erosion associated with that event. Evidence shall include a report with data and supporting analysis, and shall be certified by a professional engineer registered in this state, that the armoring was designed and constructed and is in adequate condition to meet the following criteria:
   2.1. The top must be at or above the still water level, including setup, for the design storm plus the breaking wave calculated at its highest achievable level based on the maximum eroded beach profile and highest surge level combination, and must be high enough to preclude runup overtopping.
   2.2. The armoring must be stable under the design storm including maximum localized scour, with adequate penetration and toe protection to avoid settlement, toe failure, or loss of material from beneath or behind the armoring.
   2.3. The armoring must have sufficient continuity or return walls to prevent flanking under the design storm from impacting the proposed construction.
   2.4. The armoring must withstand the static and hydrodynamic forces of the design storm.
3. A higher elevation standard is required by either the National Flood Insurance Program (NFIP), as found on a community's Flood Insurance Rate Map (FIRM), or the local flood damage prevention ordinance. In such instances, the higher elevation standard shall apply.

3109.4 Construction standards.

3109.4.1 Pile foundations. All habitable structures shall be elevated on, and securely anchored to, an adequate pile foundation. Pile foundations for habitable structures shall be designed to withstand all reasonable anticipated erosion, scour and loads resulting from a 100-year storm including wind, wave, hydrostatic and hydrodynamic forces acting simultaneously with typical structural (live and dead) loads. All habitable structures should be anchored to their pile foundation in such a manner as to prevent flotation, collapse or lateral displacement. The elevation of the soil surface to be used in the calculation of pile reactions and bearing capacities for habitable structures shall not be greater than that which would result from erosion caused by a 100-year storm event. Calculation of the design grade shall account for localized scour resulting from the presence of structural components. Design ratio or pile spacing to pile diameter should not be less than 8:1 for individual piles located above the design grade. Pile caps shall be set below the design grade unless designed to resist increased flood loads associ-

ated with setting the cap above the design grade, but at or below the natural grade. Pile penetration shall take into consideration the anticipated loss of soil above the design grade.

Exceptions:

1. Additions, repairs or modifications to existing nonconforming habitable structures that do not advance the seaward limits of the existing habitable structure and do not constitute rebuilding of the existing structure.
2. Habitable structures located landward of existing armoring which is capable of protecting buildings from the effects of erosion from a 100-year storm surge. The applicant shall provide scientific and engineering evidence that the armoring has been designed, constructed and maintained to survive the effects of the design storm and provide protection to existing and proposed structures from the erosion associated with that event. Evidence shall include a report with data and supporting analysis, and shall be certified by a professional engineer registered in this state, that the armoring was designed and constructed and is in adequate condition to meet the following criteria:
   2.1. The top must be at or above the still water level, including setup, for the design storm plus the breaking wave calculated at its highest achievable level based on the maximum eroded beach profile and highest surge level combination, and must be high enough to preclude runup overtopping.
   2.2. The armoring must be stable under the design storm including maximum localized scour, with adequate penetration and toe protection to avoid settlement, toe failure or loss of material from beneath or behind the armoring.
   2.3. The armoring must have sufficient continuity or return walls to prevent flanking under the design storm from impacting the proposed construction.
   2.4. The armoring must withstand the static and hydrodynamic forces of the design storm.

3109.4.2 Walls below the 100-year storm elevation. No substantial walls or partitions shall be constructed below the level of the first finished floor of habitable structures. All other walls shall be designed to break away.

Exceptions:

1. Stairways and stairwells;
2. Shear walls perpendicular to the shoreline;
3 Shear walls parallel to the shoreline, which are limited to a maximum of 20 percent of the building length in the direction running parallel to the shore;
4. Shear walls parallel to the shoreline, which exceed 20 percent of the total building length (including any attached major structure) when they meet the following criteria:
   4.1. A certification is provided by a Florida-registered professional engineer that certifies that the increased length of shear walls, over 20 percent, are located landward of the 100-year erosion limit;
   4.2. A hydraulic analysis is provided and certified by a Florida-registered professional engineer that evaluates the potential impact of flow increase on the subject parcel and adjacent properties;
   4.3. The hydraulic analysis demonstrates that although the overall shearwall coverage is more than 20 percent, the increased shear-wall length will not result in substantial increase of flow velocities and drag forces on the structural components of the proposed structure and neighboring structures; and
   4.4. The provisions under Section 3109.4.2 (Exception 4) do not include any low-rise building as defined in Section 1609.2.
5. Wind or sand screens constructed of fiber or wire mesh;
6. Light, open lattice partitions with individual, wooden lattice strips not greater than $^3/_4$ inch (19 mm) thick and 3 inches (76 mm) wide;
7. Elevator shafts;
8. Small mechanical and electrical rooms; and
9. Break-away or frangible walls.

3109.5 Flood loads during a 100-year storm.

3109.5.1 Load basis. The structural design shall be based on the 100-year storm as determined by the Florida Department of Environmental Protection in studies published as part of the coastal construction control line establishment process. Breaking, broken and nonbreaking waves shall be considered as applicable. Design wave loading analysis shall consider vertical uplift pressures and all lateral pressures to include impact, as well as dynamic loading and the harmonic intensification resulting from repetitive waves.

3109.5.2 Hydrostatic load. Habitable structures shall be designed in consideration of the hydrostatic loads which would be expected under the conditions of maximum inundation associated with a 100-year storm event. Calculations for hydrostatic loads shall consider the maximum water pressure resulting from a fully peaked, breaking wave superimposed on the design storm surge with dynamic wave set-up. Both free and confined hydrostatic loads shall be considered. Hydrostatic loads which are confined shall be determined using the maximum elevation to which the confined water would freely rise if unconfined. Vertical hydrostatic loads shall be considered as forces acting both vertically downward and upward on horizontal or inclined surfaces of major structures (e.g., floors, slabs, roofs, walls). Lateral hydrostatic loads shall be considered as forces acting horizontally above and below grade on verti-

cal or inclined surfaces of major structures and coastal or shore protection structures. Hydrostatic loads on irregular or curving geometric surfaces may be determined in consideration of separate vertical and horizontal components acting simultaneously under the distribution of the hydrostatic pressures.

3109.5.3 Hydrodynamic loads. Habitable structures shall be designed in consideration of the hydrodynamic loads which would be expected under the conditions of a 100-year storm event. Calculations for hydrodynamic loads shall consider the maximum water pressures resulting from the motion of the water mass associated with a 100-year storm event. Full-intensity loading shall be applied on all structural surfaces above the design grade which would affect the flow velocities.

3109.6 Wind loads. All habitable structures shall be designed in accordance with Chapter 16.

3109.7 Swimming pools. Swimming pools located in close proximity to an existing habitable structure or armoring shall be designed with an adequate pile foundation for the erosion and scour conditions of a 100-year storm event.

3109.8 Storm debris. All structures will be designed to minimize the potential for wind- and water-borne debris during a storm.

SECTION 3110
FLOOD-RESISTANT CONSTRUCTION

3110.1 Administration.

3110.1.1 Purpose. The purpose of this standard is to promote the public health, safety and general welfare and to minimize public and private losses resulting from flood conditions in specific areas through the establishment of comprehensive regulations for floodplain management, designed to:

1. Minimize loss of life and property caused by flooding conditions;
2. Prevent unnecessary disruption of commerce and public service in times of flooding;
3. Restrict or prohibit uses which are dangerous to health, safety and property because of flood or erosion hazards, or which result in increases in flood heights or velocities or erosion potential;
4. Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
5. Control the alteration of natural floodplains, stream channels and natural protective barriers;
6. Control filling, grading, dredging and other development which can increase flood damage or erosion potential;
7. Prevent or regulate the construction of flood barriers which will divert flood waters or which can increase flood hazards; and
8. Contribute to improved construction techniques in the floodplain.

3110.1.2 Floodplain management construction standards. This code specifically defers to the authority granted to local government by Title 44 CFR, Sections 59 and 60. This code is not intended to supplant or supercede local ordinances adopted pursuant to that authority, nor are local floodplain management ordinances to be deemed amendments to the code.

SECTION 3111
DEPOSIT OF MATERIAL IN TIDEWATER REGULATED

3111.1 It is not lawful for any person to discharge or cause to be discharged or deposit or cause to be deposited, in the tide or salt waters of any bay, port, harbor or river of this state, any ballast or material of any kind other than clear stone or rock, free from gravel or pebbles, which said clear stone or rock shall be deposited or discharged only in the construction of enclosures in connection with wharves, piers, quays, jetties or in the construction of permanent bulkheads connecting the solid and permanent portion of wharves. It is lawful to construct three characters of bulkheads for retention of material in solid wharves.

First, clear stone or rock enclosures, or bulkheads, may be built upon all sides to a height not less than 2½ feet (762 mm) above high watermark; and after the enclosures have been made so solid, tight and permanent as to prevent any sand, mud, gravel or other material that may be discharged or deposited in them from drifting or escaping through such enclosures, any kind of ballast may be discharged or deposited within the enclosures. The enclosures may be constructed of wood, stone and rock combined, the stone and rocks to be placed on the outside of the wood to a height not less at any point than 2½ feet (762 mm) above high watermark; and after the enclosures have been made so solid, tight and permanent as to prevent any sand, mud gravel or other material that may be discharged or deposited in them from drifting or escaping through such enclosures, any kind of ballast may be discharged or deposited within the enclosures.

Second, a bulkhead may be built by a permanent wharf consisting of thoroughly creosoted piles not less than 12 inches (305 mm) in diameter at the butt end, to be driven close together and to be capped with timber not less than 10 or 14 inches drift (254 or 302 mm), bolted to each pile, and one or more longitudinal stringers to be placed on the outside of the bulkhead and securely anchored by means of iron rods to piles driven within the bulkheads, clear rock to be on the inside of the bulkhead, to a height of not less than 2½ feet (762 mm) above high water; and after this is done, ballast or other material may be deposited within the permanent enclosure so constructed.

Third, a bulkhead may be constructed to consist of creosoted piles, as described herein, driven not exceeding 4 feet (1219 mm) apart from center to center, inside of which two or more longitudinal stringers may be placed and securely bolted to the piles. Inside of these longitudinal pieces, two thicknesses of creosoted sheet piling are to be driven, each course of the sheet piling to make a joint with the other to form an impenetrable

wharf; and within this permanent bulkhead so constructed, any ballast or other material may be deposited.

No such enclosure, pier, quay or jetty shall be begun until the point whereat it is to be built shall have been connected by a substantial wharf with a shore or with a permanent wharf; except that the owners of wharves may at any time, with the consent of the Board of Pilot Commissioners of the Division of Professions of the Department of Business and Professional Regulation, build wharves of clear stone or rock, or creosoted walls as hereinafter provided, on each side of their wharves from the shore to a point at which the water is not more than 15 feet (4.6 m) deep, and when such walls have attained a height of $2^1/_2$ feet (762 mm) above high watermark and have been securely closed at the deepwater end by stone or creosoted walls of the same height, any kind of ballast may be deposited in them.

Nothing contained in this section shall interfere with any rights or privileges now enjoyed by riparian owners. While this section empowers those who desire to construct the several characters of wharves, piers, quays, jetties and bulkheads provided for and described herein, nothing in this section shall be construed to require any person not desiring to construct a permanent wharf by filling up with ballast, stone or other material to construct under the specifications contained herein; and nothing in this chapter shall be so construed as to prevent any person from constructing any wharf or placing any pilings, logs or lumber in any waters where the person would have heretofore had the right so to do.

3111.2 This section shall not prohibit Escambia County from placing in Pensacola Bay, on the Escambia County side, beside the old Pensacola Bay Bridge, certain materials, as recommended by the Department of Environmental Protection, in coordination with the Fish and Wildlife Conservation Commission, to increase the number of fish available for persons fishing from the old Pensacola Bay Bridge.

3111.3 This section shall not prohibit Manatee County from placing in the Manatee County portions of Sarasota Bay and Tampa Bay and in the Manatee River, certain materials, as recommended by the Department of Environmental Protection, in coordination with the Fish and Wildlife Conservation Commission, to increase the number of fish available for persons fishing in the above areas.

3111.4 This section shall not prohibit Pinellas County from placing in Tampa Bay certain materials as recommended by the Department of Environmental Protection, in coordination with the Fish and Wildlife Conservation Commission, to increase the number of fish available for persons fishing in the bay. Deposit of material on a wharf or quay is regulated. It is not lawful for any person to deposit or cause to be deposited on any wharf or quay, any ballast, stone, earth or like material, except such wharf or quay may be secured to prevent such ballast or other material from washing into the waters of the harbor.

SECTION 3112
LIGHTING, MIRRORS, LANDSCAPING

3112.1 Each operator of an automated teller machine that controls the access area or defined parking area to be lighted shall comply with Sections (2), (3), and (4) no later than one year after October 1, 1994. If the access area or defined parking area to be lighted is controlled by a person other than the operator, such other person shall comply with Sections (2), (3), and (4) no later than one year after October 1, 1994.

3112.2 Each operator, or other person responsible for an automated teller machine pursuant to Sections 655.960 through 655.965, *Florida Statutes*, shall provide lighting during the hours of darkness with respect to an open and operating automated teller machine and any defined parking area, access area and the exterior of an enclosed automated teller machine installation, as follows:

1. There shall be a minimum of 10 footcandle (108 lux) power at the face of the automated teller machine and extending in an unobstructed direction outward 5 feet (1.5 m).
2. There shall be a minimum of 2 footcandle (21.5 lux) power within 50 feet (15.25 m) in all unobstructed directions from the face of the automated teller machine. If the automated teller machine is located within 10 feet (3 m) of the corner of the building and the automated teller machine is generally accessible from the adjacent side, there shall be a minimum of 2 footcandle (21.5 lux) power along the first 40 unobstructed feet (12 m) of the adjacent side of the building.
3. There shall be a minimum of 2 footcandle (21.5 lux) power in that portion of the defined parking area within 60 feet (18 m) of the automated teller machine.
4. The operator shall provide reflective mirrors or surfaces at each automated teller machine which provide the customer with a rear view while the customer is engaged in using the automated teller machine.
5. The operator, or other person responsible pursuant to Sections 655.960 through 655.965, *Florida Statutes*, for an automated teller machine, shall ensure that the height of any landscaping, vegetation or other physical obstructions in the area required to be lighted pursuant to Section (2) for any open and operating automated teller machine shall not exceed 3 feet (914 mm), except that trees trimmed to a height of 10 feet (3 m) and whose diameters are less than 2 feet (610 mm) and manmade physical obstructions required by statute, law, code, ordinance or other governmental regulation shall not be affected by this section.

SECTION 3113
AIRPORT NOISE

3113.1 Airport noise study guidelines. The Aviation Safety and Noise Abatement Act of 1979, 14 CFR Part 150 (U.S. Department of Transportation), including revisions through January, 2005, is hereby adopted as a guideline for establishing airport noise control.

CHAPTER 32
ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

SECTION 3201
GENERAL

3201.1 Scope. The provisions of this chapter shall govern the encroachment of structures into the public right-of-way.

3201.2 Measurement. The projection of any structure or portion thereof shall be the distance measured horizontally from the lot line to the outermost point of the projection.

3201.3 Other laws. The provisions of this chapter shall not be construed to permit the violation of other laws or ordinances regulating the use and occupancy of public property.

3201.4 Drainage. Drainage water collected from a roof, awning, canopy or marquee, and condensate from mechanical equipment shall not flow over a public walking surface.

SECTION 3202
ENCROACHMENTS

3202.1 Encroachments below grade. Encroachments below grade shall comply with Sections 3202.1.1 through 3202.1.3.

3202.1.1 Structural support. A part of a building erected below grade that is necessary for structural support of the building or structure shall not project beyond the lot lines, except that the footings of street walls or their supports which are located at least 8 feet (2438 mm) below grade shall not project more than 12 inches (305 mm) beyond the street lot line.

3202.1.2 Vaults and other enclosed spaces. The construction and utilization of vaults and other enclosed space below grade shall be subject to the terms and conditions of the authority or legislative body having jurisdiction.

3202.1.3 Areaways. Areaways shall be protected by grates, guards or other approved means.

3202.2 Encroachments above grade and below 8 feet in height. Encroachments into the public right-of-way above grade and below 8 feet (2438 mm) in height shall be prohibited except as provided for in Sections 3202.2.1 through 3202.2.3. Doors and windows shall not open or project into the public right-of-way.

3202.2.1 Steps. Steps shall not project more than 12 inches (305 mm) and shall be guarded by approved devices not less than 3 feet (914 mm) high, or shall be located between columns or pilasters.

3202.2.2 Architectural features. Columns or pilasters, including bases and moldings shall not project more than 12 inches (305 mm). Belt courses, lintels, sills, architraves, pediments and similar architectural features shall not project more than 4 inches (102 mm).

3202.2.3 Awnings. The vertical clearance from the public right-of-way to the lowest part of any awning, including valances, shall be 7 feet (2134 mm) minimum.

3202.3 Encroachments 8 feet or more above grade. Encroachments 8 feet (2438 mm) or more above grade shall comply with Sections 3202.3.1 through 3202.3.4.

3202.3.1 Awnings, canopies, marquees and signs. Awnings, canopies, marquees and signs shall be constructed so as to support applicable loads as specified in Chapter 16. Awnings, canopies, marquees and signs with less than 15 feet (4572 mm) clearance above the sidewalk shall not extend into or occupy more than two-thirds the width of the sidewalk measured from the building. Stanchions or columns that support awnings, canopies, marquees and signs shall be located not less than 2 feet (610 mm) in from the curb line.

3202.3.2 Windows, balconies, architectural features and mechanical equipment. Where the vertical clearance above grade to projecting windows, balconies, architectural features or mechanical equipment is more than 8 feet (2438 mm), 1 inch (25 mm) of encroachment is permitted for each additional 1 inch (25 mm) of clearance above 8 feet (2438 mm), but the maximum encroachment shall be 4 feet (1219 mm).

3202.3.3 Encroachments 15 feet or more above grade. Encroachments 15 feet (4572 mm) or more above grade shall not be limited.

3202.3.4 Pedestrian walkways. The installation of a pedestrian walkway over a public right-of-way shall be subject to the approval of local authority having jurisdiction. The vertical clearance from the public right-of-way to the lowest part of a pedestrian walkway shall be 15 feet (4572 mm) minimum.

3202.4 Temporary encroachments. Where allowed by the local authority having jurisdiction, vestibules and storm enclosures shall not be erected for a period of time exceeding 7 months in any one year and shall not encroach more than 3 feet (914 mm) nor more than one-fourth of the width of the sidewalk beyond the street lot line. Temporary entrance awnings shall be erected with a minimum clearance of 7 feet (2134 mm) to the lowest portion of the hood or awning where supported on removable steel or other approved noncombustible support.

3202.5 Sidewalk or street obstructions. Unless allowed by the applicable governing authority having jurisdiction of the right-of-way or public property, public property shall be maintained clear of any and all obstructions, including among others, posts, columns, display of wares or merchandise and sidewalk signs.

CHAPTER 33
SAFEGUARDS DURING CONSTRUCTION

SECTION 3301
GENERAL

3301.1 Scope. The provisions of this chapter shall govern safety during construction and the protection of adjacent public and private properties.

3301.2 Storage and placement. Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

SECTION 3302
CONSTRUCTION SAFEGUARDS

3302.1 Remodeling and additions. Required exits, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during remodeling, alterations, repairs or additions to any building or structure.

Exceptions:

1. When such required elements or devices are being remodeled, altered or repaired, adequate substitute provisions shall be made.
2. When the existing building is not occupied.

3302.2 Manner of removal. Waste materials shall be removed in a manner which prevents injury or damage to persons, adjoining properties and public rights-of-way.

SECTION 3303
DEMOLITION

3303.1 Construction documents. Construction documents and a schedule for demolition must be submitted when required by the building official. Where such information is required, no work shall be done until such construction documents or schedule, or both, are approved.

3303.2 Pedestrian protection. The work of demolishing any building shall not be commenced until pedestrian protection is in place as required by this chapter.

3303.3 Means of egress. A party wall balcony or horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved.

3303.4 Vacant lot. Where a structure has been demolished or removed, the vacant lot shall be filled and maintained to the existing grade or in accordance with the ordinances of the jurisdiction having authority.

3303.5 Water accumulation. Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

3303.6 Utility connections. Service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the authority having jurisdiction.

SECTION 3304
SITE WORK

3304.1 Excavation and fill. Excavation and fill for buildings and structures shall be constructed or protected so as not to endanger life or property. Stumps and roots shall be removed from the soil to a depth of at least 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building. Wood forms which have been used in placing concrete, if within the ground or between foundation sills and the ground, shall be removed before a building is occupied or used for any purpose. Before completion, loose or casual wood shall be removed from direct contact with the ground under the building.

3304.1.1 Slope limits. Slopes for permanent fill shall not be steeper than one unit vertical in two units horizontal (50-percent slope). Cut slopes for permanent excavations shall not be steeper than one unit vertical in two units horizontal (50-percent slope). Deviation from the foregoing limitations for cut slopes shall be permitted only upon the presentation of a soil investigation report acceptable to the building official.

3304.1.2 Surcharge. No fill or other surcharge loads shall be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or surcharge. Existing footings or foundations which can be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against later movement.

3304.1.3 Footings on adjacent slopes. For footings on adjacent slopes, see Chapter 18.

3304.1.4 Fill supporting foundations. Fill to be used to support the foundations of any building or structure shall comply with Section 1803.5.

SECTION 3305
SANITARY

3305.1 Facilities required. Sanitary facilities shall be provided during construction, remodeling or demolition activities in accordance with the *Florida Building Code, Plumbing.*

SECTION 3306
PROTECTION OF PEDESTRIANS

3306.1 Protection required. Pedestrians shall be protected during construction, remodeling and demolition activities as required by this chapter and Table 3306.1. Signs shall be provided to direct pedestrian traffic.

3306.2 Walkways. A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the authority having jurisdiction authorizes the sidewalk to be fenced or closed. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but in no case shall they be less than 4 feet (1219 mm) in width. Walkways shall be provided with a durable walking surface. Walkways shall be accessible in accordance with Chapter 11 and shall be designed to support all imposed loads and in no case shall the design live load be less than 150 pounds per square foot (psf) (7.2 kN/m^2).

3306.3 Directional barricades. Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

3306.4 Construction railings. Construction railings shall be at least 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.

3306.5 Barriers. Barriers shall be a minimum of 8 feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors which are normally kept closed.

3306.6 Barrier design. Barriers shall be designed to resist loads required in Chapter 16 unless constructed as follows:

1. Barriers shall be provided with 2-inch by 4-inch (51 mm by 102 mm) top and bottom plates.
2. The barrier material shall be a minimum of $^3/_4$-inch (19.1 mm) boards or $^1/_4$-inch (6.4 mm) wood structural use panels.
3. Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.
4. Wood structural use panels $^1/_4$ inch (6.4 mm) or $^5/_{16}$ inch (23.8 mm) in thickness shall have studs spaced not more than 2 feet (610 mm) on center (o.c.).
5. Wood structural use panels $^3/_8$ inch (9.5 mm) or $^1/_2$ inch (12.7 mm) in thickness shall have studs spaced not more than 4 feet (1219 mm) o.c., provided a 2-inch by 4-inch (51 mm by 102 mm) stiffener is placed horizontally at midheight where the stud spacing exceeds 2 feet (610 mm) o.c.
6. Wood structural use panels $^5/_8$ inch (15.9 mm) or thicker shall not span over 8 feet (2438 mm).

3306.7 Covered walkways. Covered walkways shall have a minimum clear height of 8 feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed loads. In no case shall the design live load be less than 150 psf (7.2 kN/m^2) for the entire structure.

Exception: Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories in height are permitted to be designed for a live load of 75 psf (3.6kN/m^2) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:

1. Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.
2. Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) o.c.
3. Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge upon the posts.
4. Joists resting on the stringers shall be at least 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) o.c.
5. The deck shall be planks at least 2 inches (51 mm) thick or wood structural panels with an exterior exposure durability classification at least $^{23}/_{32}$ inch (18.3 mm) thick nailed to the joists.

TABLE 3306.1
PROTECTION OF PEDESTRIANS

HEIGHT OF CONSTRUCTION	DISTANCE FROM CONSTRUCTION TO LOT LINE	TYPE OF PROTECTION REQUIRED
8 feet or less	Less than 5 feet	Construction railings
	5 feet or more	None
More than 8 feet	Less than 5 feet	Barrier and covered walkway
	5 feet or more, but not more than one-fourth the height of construction	Barrier and covered walkway
	5 feet or more, but between one-fourth and one-half the height of construction	Barrier
	5 feet or more, but exceeding one-half the height of construction	None

For SI: 1 foot = 304.8 mm.

6. Each post shall be knee braced to joists and stringers by 2-inch by 4-inch (51 mm by 102 mm) minimum members 4 feet (1219 mm) long.
7. A 2-inch by 4-inch (51 mm by 102 mm) minimum curb shall be set on edge along the outside edge of the deck.

3306.8 Repair, maintenance and removal. Pedestrian protection required by this chapter shall be maintained in place and kept in good order for the entire length of time pedestrians may be endangered. The owner or the owner's agent, upon the completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.

3306.9 Adjacent to excavations. Every excavation on a site located 5 feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than 6 feet (1829 mm) high. Where located more than 5 feet (1524 mm) from the street lot line, a barrier shall be erected when required by the building official. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16.

SECTION 3307
PROTECTION OF ADJOINING PROPERTY

3307.1 Protection required. Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection must be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. The person making or causing an excavation to be made shall provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.

SECTION 3308
TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

3308.1 Storage and handling of materials. The temporary use of streets or public property for the storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the authority having jurisdiction and this chapter.

3308.1.1 Obstructions. Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

3308.2 Utility fixtures. Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

SECTION 3309
FIRE EXTINGUISHERS

[F] 3309.1 Where required. All structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

3309.2 Fire hazards. The provisions of this code and the *Florida Fire Prevention Code* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

SECTION 3310
EXITS

3310.1 Stairways required. Where a building has been constructed to a height greater than one story, or where an existing building exceeding one story in height is altered, at least one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected as the construction progresses. During construction, the stairway shall be enclosed where the building exterior walls are in place.

3310.2 Maintenance of exits. Required means of egress shall be maintained at all times during construction, demolition, remodeling or alterations and additions to any building.

Exception: Approved temporary means of egress systems and facilities.

3310.3 Stairway floor number signs. Temporary stairway floor number signs shall be provided in accordance with the requirements of Section 1020.1.6.

[F] SECTION 3311
STANDPIPES

3311.1 Where required. Buildings four stories or more in height shall be provided with not less than one standpipe for use during construction. Such standpipes shall be installed where the progress of construction is not more than 40 feet (12 192 mm) in height above the lowest level of fire department access. Such standpipe shall be provided with fire department hose connections at accessible locations adjacent to usable stairs. Such standpipes shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring.

3311.2 Buildings being demolished. Where a building is being demolished and a standpipe exists within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

3311.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Chapter 9.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 as to capacity, outlets and materials.

3311.4 Water supply. Water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates.

SECTION 3312
AUTOMATIC SPRINKLER SYSTEM

[F] 3312.1 Completion before occupancy. In buildings where an automatic sprinkler system is required by this code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in Section 109.

[F] 3312.2 Operation of valves. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

CHAPTER 34
EXISTING STRUCTURES

SECTION 3401
GENERAL

3401.1 Scope. Alteration, repair, addition, relocation and change of occupancy of existing structures and buildings shall comply with the provisions of the *Florida Building Code, Existing Building*.

Exception: Reserved.

3401.2 Maintenance. Reserved.

3401.3 Compliance with other codes. Reserved.

SECTION 3402
DEFINITIONS
RESERVED

SECTION 3403
ADDITIONS, ALTERATIONS OR REPAIRS
RESERVED

SECTION 3404
FIRE ESCAPES
RESERVED

SECTION 3405
GLASS REPLACEMENT
RESERVED

SECTION 3406
CHANGE OF OCCUPANCY
RESERVED

SECTION 3407
HISTORIC BUILDINGS
RESERVED

SECTION 3408
MOVED STRUCTURES
RESERVED

SECTION 3409
ACCESSIBILITY FOR EXISTING BUILDINGS
RESERVED

SECTION 3410
COMPLIANCE ALTERNATIVES
RESERVED

CHAPTER 35

REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.

AA

Aluminum Association
1525 Wilson Blvd, Suite 600
Arlington, VA 22209

Standard reference number	Title	Referenced in code section number
ADM 2005	Aluminum Design Manual: Part 1-A Specification for Aluminum Structures, Allowable Stress Design; and Part 1-B Specification for Aluminum Structures, Building Load and Resistance Factor Design	1604.3.5, 2002.2, 2003.2
	Specifications for Aluminum Structures	2003.2
	The Aluminum Formed Sheet Building Sheathing Design Guide	2003.2
	The Commentary on Specifications for Aluminum Structures	2003.2
	Engineering Data for Aluminum Structures	2003.2
ASM 35—00	Aluminum Sheet Metal Work in Building Construction (Fourth Edition)	2002.1

AAF

Aluminum Association of Florida, Inc.
1650 Dixie Hwy, Suite 500
Boca Raton, FL 33432

Standard reference number	Title	Referenced in code section number
AAF—07	Guide to Aluminum Construction in High Wind Areas 2007	2002.4.1

AAMA

American Architectural Manufacturers Association
1827 Waldon Office Square, Suite 550
Schaumburg, IL 60173

Standard reference number	Title	Referenced in code section number
101/I.S.2—97	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	1008.1.6, 1714.5.2.1, 1714.5.2.2, 2411.3.2.1
101/I.S.2/NAFS—02	Voluntary Performance Specification for Windows, Skylights and Glass Doors	1714.5.2.1, 1714.5.2.1.1, 2405.5, 2612.2
103.3—83	Procedural Guide, Sec. 2 — Engineering Design Rules	2411.3.2.6
203—98	Procedural Guide for the Window Inspection and Notification System	1714.5.2.2
501—05	Method for Test for Exterior Wall	1714.5.2.1, 1714.5.2.1.1, 1714.5.3.3.1, 2405.5, 2411.3.2.1.1, 2612.2
AAMA/WDMA/CSA101/ I.S.2/A440-05	Specifications for Windows, Doors and Unit Skylights	1714.5.2.1
AAMA 450-06	Voluntary Performance Rating Method for Mulled Fenestration Assemblies	1714.5.5.1, 1714.5.5.1.2, 1714.5.5.1.3
AAMA 506-06	Voluntary Specifications for Hurricane Impact and Cycle Testing of Fenestration Products	1609.1.4
AAMA 800–05	Voluntary Specifications and Test Methods for Sealants	2510.8
AAMA 812-04	Voluntary Practice for Assessment of Single Component Aerosol Expanding Polyurethane Foams for Sealing Rough Openings of Fenestration Installations	2510.8
AAMA 1402–86	Standard Specifications for Aluminum Siding, Soffit and Fascia	1404.5.1
AAMA/NPEA/NSA 2100-02	Voluntary Specifications for Sunrooms	2002.6

AASHTO

American Association of State Highway & Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
LTS 4	Structural Specifications for Highway Signs, Luminaires and Traffic Signals	1609.1.1

ACI

American Concrete Institute
P.O. Box 9094
Farmington Hills, MI 48333-9094

Standard reference number	Title	Referenced in code section number
117	Standard Tolerances for Concrete Construction and Materials	1920.2
216.1–97	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies	Table 720.1(2), 721.1
224.3R—95	Joints in Concrete Construction (Reapproved 2001)	1911.2
301	Specifications for Structural Concrete for Buildings	1920.2
315	Manual of Standard Practice for Detailing Reinforced Concrete Structures	1920.2
318—05	Building Code Requirements for Structural Concrete	1604.3.2, 1805.4.2.6,1805.9, 1806.4,1808.2.23.1.1, 1808.2.23.2, 1808.2.23.2.1, 1808.2.23.2.2, 1809.2.3.2, 1809.2.3.2.2, 1810.1.2.2, 1812.8, 1901.2, 1901.3, 1901.4, 1902, 1903.1, 1903.2, 1903.3, 1903.4, 1903.5.1, 1903.6, 1904.4.2, 1905.1.4, 1905.3, 1905.4, 1905.5, 1905.6.5.5, 1905.8.3, 1905.11.3, 1906.1.5, 1906.3, 1906.4.3, 1907.1, 1907.2, 1907.4.1, 1907.6, 1907.7.2, 1907.7.3, 1907.7.4, 1907.7.5, 1907.8, 1907.9, 1907.10, 1907.11, 1907.12, 1907.13, 1908, 1908.1.1, 1908.1.2, 1908.1.3, 1908.1.4, 1908.1.5, 1908.1.6, 1908.1.7, 1908.1.8, 1908.1.9, 1909.1, 1909.3, 1909.4, 1909.5, 1909.6, 1910, 1910.2.1, 1910.2.2, 1910.2.3, 1910.2.4, 1910.3.1, 1910.4.1, 1910.4.2, 1910.4.3, 1910.4.3.1, 1910.5.2, 1913.1, 1918.1, 1918.2, 1919.3, 1920.2, 1921.1, 1922.4.1, 1922.4.3, 1922.6.4, 1926.4.1, 1926.4.3, 1926.5.6, 1928.3.1, 1928.7.2, 2108.3
347	Recommended Practice for Concrete Foamwork	1920.2, 1925.1.1
506	Recommended Practice for Shotcreting	1920.2
506.2	Specification for Shotcrete	1920.2, 1929.1.2, 1929.8.1
530—05	Building Code Requirements for Masonry Structures	1405.5, 1405.5.3, 1405.9, 1604.3.4, 1605.3.1.1, 1618.9,1805.5.2, 1812.7, 2101.2.3, 2101.2.4, 2101.2.5, 2103.11.6, 2106.1, 2106.1.1.1, 2106.1.1.2, 2106.1.1.3, 2106.3, 2106.4, 2106.5, 2106.6, 2107.1, 2107.2, 2107.2.1, 2107.2.2, 2107.2.4, 2107.2.5, 2107.2.6, 2108.1, 2108.2, 2108.3, 2108.4, 2109.1, 2109.2.3.1, 2109.2.3.2, 2114.2, 2121.2.12, 2122.1
530.1—05	Specifications for Masonry Structures	1405.5.1, Table 1704.5.1, Table 1704.5.3, 2103.13.7, 2104.1, 2104.1.1, 2104.3, 2104.4

AF&PA

American Forest & Paper Association
1111 19th St, NW Suite 800
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
AF&PA—87 (HVHZ)	All-Weather Wood Foundation System, Design, Fabrication, Installation Manual	2314.4.7
AF&PA—92	Wood Structural Design Data	2314.4.7
AF&PA—93	Span Tables for Joists and Rafters	2306.1.1, 2308.8, 2308.10.2, 2308.10.3
NDS—05	National Design Specification (NDS) for Wood Construction— with 2005 Supplement	721.6.3.2, 1715.1.1, 1715.1.4, 1805.4.5, 1808.1, 1823.1.8.1, 2306.1, 2306.2.1, 2306.3.2, Table 2306.3.1, Table 2306.4.1, 2306.3.4, 2306.3.5, 2306.4.1, Table 2308.9.3(4), 2314.4.7, 2315.4.1, 2319.17.2.2.1, 2319.17.2.1.3, 2319.17.2.1.5
SDPWS–05	AF&PA Supplement Special Design Provisions for Wind and Seismic	2305.1
T.R. No. 7—87	Permanent Wood Foundation System	1805.4.6, 1807.2, 2304.9.5, 2314.4.7
WCD 1—01	Wood Construction Data No. 1, Details for Conventional Wood Frame Construction	2314.4.7
WCD 3—83	Wood Construction Data No. 3, Design of Wood Formwork for Concrete Structures	2314.4.7
WCD 4—89	Wood Construction Data No. 4, Plank and Beam Framing for Residential Buildings	2306.1.2, 2314.4.7
WCD 5—89	Wood Construction Data No. 5, Heavy Timber Construction Details	2314.4.7
WCD 6—88	Wood Construction Data No. 6, Design of Wood Frame Structures for Permanence	2314.4.7, 2326.2.11
WFCM–01	Wood Frame Construction Manual for One- and Two-family Dwellings	2301.2, 2308.1, 2308.2.1

AHA

American Hardwood Association
1210 West N.W. Highway
Palatine, IL 60067

Standard reference number	Title	Referenced in code section number
A135.4—2004	Basic Hardboard	1404.3.1, 2303.1.6, 2314.4.1
A135.5—2004	Prefinished Hardboard Paneling	2303.1.6, 2304.6.2, 2314.4.1
A135.6—98	Hardboard Siding	1404.3.2, 2303.1.6, 2314.4.1
A194.1—85	Cellulosic Fiber Board	2303.1.5, 2314.4.1
IB Spec. No. 1	Recommended Product and Application Specification —Structural Insulating Roof Deck	2314.4.1
IB Spec. No. 2	Recommended Product and Application Specification —1/2 inch Fiberboard Nail-Base Sheathing	2314.4.1
IB Spec. No. 3	Recommended Product and Application Specification —1/2inch Intermediate Fiberboard Sheathing	2314.4.1

AIA

American Institute of Architects
1735 New York Avenue N.W.
Washington, D.C. 20006-5292

Standard reference number	Title	Referenced in code section number
HHCF 06	Guideline for the Design and Construction of Health Care Facilities	419.2.1.2, 419.2.2, 419.3.2, 419.3.3, 419.3.4, 419.3.4.1, 419.3.4.2, 419.3.5, 419.3.5.1, 419.3.5.2, 419.3.6, 419.3.6.1, 419.3.7, 419.3.8.8, 419.3.8.9, 419.3.9, 419.3.10, 419.3.11, 419.3.13, 419.3.15, 419.3.17, 420.2.2, 420.2.5, 421.2.1.2, 421.2.2, 421.3.2, 421.3.2.1, 421.3.2.2, 421.3.3, 421.3.3.2.2, 421.3.3.3, 421.3.4, 421.3.5, 421.3.10

AISC

American Institute of Steel Construction
One East Wacker Drive, Suite 3100
Chicago, IL 60601-2001

Standard reference number	Title	Referenced in code section number
341—05	Seismic Provisions for Structural Steel Buildings, including Supplement No. 1 dated 2006	1613.6.2, 1707.2, 1708.4, 2205.2.1, 2205.2.2, 2205.3, 2205.3.1
360—05	Specification for Structural Steel Buildings	1604.3.3, Table 1704.3, 2203.2, 2205.1, 2205.3
AISC	Tortional Analysis of Steel Members	2214.3
AISC	Detailing for Steel Construction	2214.3
AISC	Engineering for Steel Construction	2214.3
AISC	Iron and Steel Beams - 1873 to 1952	2214.3
AISC	Plastic Design in Steel	2214.3
AISC	Plastic Design of Braced Multistory Steel Frames	2214.3
AISC	Serviceability Design Considerations for Low-Rise Buildings	2214.3, 2223.5.2
AISC	Simple Shear Connection, ASD	2214.3
AISC	Simple Shear Connections, LRFD	2214.3
AISC	Allowable Stress Design, Manual of Steel Construction	2214.3
AISC	Load Resistance Factor Design, Manual of Steel Construction	2214.3
AISC	Metal Building Certification Program, Category MB Certified	2223.11.2

AISI

American Iron and Steel Institute
1140 Connecticut Avenue
Suite 705
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
AISI	Design Manual For Cold-Formed Steel	2214.3
AISI	Design Manual for Structural Tubing	2214.3
Z—2	Designing Fire Protection for Steel Trusses	2214.3
Z—3	Designing Fire Protection for Steel Columns (Beams), No column listed	2214.3

AISI - continued

AISI	Fire-Resistant Steel-Frame Construction	2214.3
AISI	Fire-Safe Structural Steel - A Design Guide	2214.3
AISI	Specifications for Design of Light-Gage Cold-Formed Stainless Structural Members	2214.3
AISI	Specification for the Criteria for Structural Application of Steel Cables for Buildings	2214.3
SG02—01	North American Specification for Design of Cold-Formed Steel Structural Members	2214.3
NAS—01	North American Specification for the Design of Cold-formed Steel Structural Members, including 2004 Supplement	1604.3.3, 2209.1, 2210.1
General—04	Standard for Cold-formed Steel Framing—General Provisions	1604.3.3, 2210.1
Header—04	Standard for Cold-formed Steel Framing—Header Design	2210.2
Lateral—04	Standard for Cold-formed Steel Framing—Lateral Design	2210.5
PM—01	Standard for Cold-formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings, including 2004 Supplement	2210.6
Truss—04	Standard for Cold-formed Steel Framing—Truss Design	1604.3.3, 2210.3
WSD—04	Standard for Cold-formed Steel Framing—Wall Stud Design	2210.4

AITC

American Institute of Timber Construction
Suite 140
7012 S. Revere Parkway
Englewood, CO 80112

Standard reference number	Title	Referenced in code section number
Technical Note 7—96	Calculation of Fire Resistance of Glued Laminated Timbers	721.6.3.3, 2314.4.2
104—03	Typical Construction Details	2306.1, 2314.4.2
106	Code of Suggested Practices	2314.4.2
108–93	Standard for Heavy Timber Construction	2314.4.2
109–98	Standard for Preservative Treatment for Structural Glued Laminated Timber	2314.4.2
110—01	Standard Appearance Grades for Structural Glued Laminated Timber	2306.1, 2314.4.2
112–93	Tongue-and-Groove Heavy Timber Roof Decking	2306.1, 2314.4.2
113—01	Standard for Dimensions of Structural Glued Laminated Timber	2306.1, 2314.4.2
117—04	Standard Specifications for Structural Glued Laminated Timber of Softwood Species	2306.1, 2314.4.2
119—96	Standard Specifications for Structural Glued Laminated Timber of Hardwood Species	2306.1
200—04	Manufacturing Quality Control Systems Manual for Structural Glued Laminated Timber	2306.1
ANSI/AITC A 190.1—02	Structural Glued Laminated Timber	2303.1.3, 2306.1, 2314.4.2, 2315.1.1

ALI

Automotive Lift Institute
P.O. Box 85
Courtland, NY 13045

Standard reference number	Title	Referenced in code section number
ALI ALCTV—98	Standard for Automotive Lifts—Safety Requirements for Construction, Testing and Validation (ANSI)	3001.2

ANSI

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

Standard reference number	Title	Referenced in code section number
A13.1—96 (Reaffirmed 2002)	Scheme for the Identification of Piping Systems	415.8.6.4
A 41.1	Building Code Requirements for Masonry	2119.1.1, 2121.2.8
A 41.2	Building Code Requirements for Reinforced Masonry	2119.1.1
A 42.1	Specification For Gypsum Plastering	2515.1.1
A 42.4	Standard Specification for Interior Lathing and Furring	2514.1
A 97.1	Specification for the Application and Finishing of Gypsum Wallboard	2517.2
A108.1A—99	Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar	2103.10
A108.1B—99	Installation of Ceramic Tile, quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-portland Mortar	2103.10

ANSI - continued

A108.4—99	Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive	2103.10.6
A108.5—99	Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-portland Cement Mortar	2103.9.3, 2103.10.1, 2103.10.2
A108.6—99	Installation of Ceramic Tile with Chemical-resistant, Water Cleanable Tile-setting and -grouting Epoxy	2103.10.3
A108.8—99	Installation of Ceramic Tile with Chemical-resistant Furan Resin Mortar and Grout	2103.10.4
A108.9—99	Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout	2103.10.5
A108.10—99	Installation of Grout in Tilework	2103.10.7
A 112.19.8M—87(R1996)	Suction Fittings for Use in Swimming Pools, Spas, Hot Tubs and Whirlpool Bathtub Appliances	424.2.6.6.2
A118.1—99	American National Standard Specifications for Dry-set Portland Cement Mortar	2103.10.1
A118.3—99	American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive	2103.10.3
A118.4—99	American National Standard Specifications for Latex-portland Cement Mortar	2103.10.2
A118.5—99	American National Standard Specifications for Chemical Resistant Furan Mortar and Grouts for Tile Installation	2103.10.4
A118.6—99	American National Standard Specifications for Cement Grouts for Tile Installation	2103.10.7
A118.8—99	American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout	2103.10.5
A136.1—99	American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile	2103.10.6
A137.1—88	American National Standard Specifications for Ceramic Tile	2103.5
A208.1—99	Particleboard	2303.1.7, 2303.1.7.1
Z 53.1	American National Standard Safety Color Code for Marking Physical Hazards	423.4.6, 423.14.6
Z 97.1—84 (R1994)	Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test (Reaffirmed 1994)	1618.4.6.3, 2406.1.2, 2409.1, 2411.1.4, 2411.1.6, 3010.1

APA

APA - Engineered Wood Association
P.O. Box 11700
Tacoma, WA 98411-0700

Standard reference number	Title	Referenced in code section number
APA E30	Engineered Wood Construction Guide	2314.4.3
APA PDS-Y510J—04	Plywood Design Specification (revised 1998)	2306.1, Table 2306.3.1, 2306.3.2, 2306.4.1, 2314.4.3
APA PDS—04	Panel Design Specification	2306.1, 2306.3.1, 2306.4.1
APA PDS Supplement 1—90	Design and Fabrication of Plywood Curved Panels (revised 1995)	2306.1, 2314.4.3
APA PDS Supplement 2—92	Design and Fabrication of Plywood-lumber beams (revised 1998)	2306.1, 2314.4.3
APA PDS Supplement 3—90	Design and Fabrication of Plywood Stressed-skin Panels (revised 1996)	2306.1, 2314.4.3
APA PDS Supplement 4—90	Design and Fabrication of Plywood Sandwich Panels (revised 1993)	2306.1, 2314.4.3
APA PDS Supplement 5—95	Design and Fabrication of All-plywood Beams (revised 1995)	2306.1, 2314.4.3
APA B840	Siding Manufacturing Specifications	2314.4.3
APA L350	Design/Construction Guide Diaphragms and Shearwalls	2314.4.3
APA PRP108	Performance Standards and Policies for Structural-Use Panels	2314.4.3, 2315.1.2
APA V910	Plywood Folded Plate Laboratory Report 21	2314.4.3
EWS R540—96	Builders Tips: Proper Storage and Handling of Glulam Beams	2306.1
EWS S475—01	Glued Laminated Beam Design Tables	2306.1
EWS S560—03	Field Notching and Drilling of Glued Laminated Timber Beams	2306.1
EWS T300—02	Glulam Connection Details	2306.1
EWS X440—00	Product Guide—Glulam	2306.1
EWS X450—01	Glulam in Residential Construction —Western Edition	2306.1

ASAE

American Society of Agricultural Engineers
2950 Niles Road
St. Joseph, MI 49085-9659

Standard reference number	Title	Referenced in code section number
EP 484.2 (1998)	Diaphragm Design of Metal-clad, Post-frame Rectangular Buildings	2306.1
EP 486.1 (2000)	Shallow-post Foundation Design	2306.1
EP 559 (1997)	Design Requirements and Bending Properties for Mechanically Laminated Columns	2306.1

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400

Standard reference number	Title	Referenced in code section number
3—91	Structural Design of Composite Slabs	1604.3.3, 1920.3, 2209.2, 2214.3
5—05	Building Code Requirements for Masonry Structures	1405.5, 1405.5.2, 1405.9, 1604.3.4, 1618.9, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, Table 1704.5.3, 1708.1.1, 1708.1.2, 1708.1.3, 1708.1.4, 1805.5.2, 1812.7, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2106.1.1, 2106.1.1.1, 2106.1.1.2, 2106.1.1.3, 2106.3, 2106.4, 2106.5, 2106.6, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2107.6, 2107.7, 2170.8, 2108.1, 2108.2, 2108.3, 2108.4, 2109.1, 2109.2.3.1, 2109.7.3, 2121.2.12, 2122.1
6—05	Specifications for Masonry Structures	1405.5.1, Table 1704.5.1, Table 1704.5.3, 1805.5.2.2, 2103.13.7, 2104.1, 2104.1.1, 2104.3, 2104.4
7—05	Minimum Design Loads for Buildings and Other Structures including Supplement No. 1 and excluding Chapter 14 and Appendix 11A	419.4.2.2.6, 420.4.2.2.6, 423.4.7, 423.9.1, 423.25.4, 423.28.2.6.4, 1514.4, 1605.1, 1605.2.2, 1605.3.1.2, 1605.3.2, 1608.1, 1608.3, 1608.3.4, 1608.3.5, 1608.4, 1608.5, 1608.6, 1608.7, 1608.8, 1608.9, 1609.1.1, 1609.1.4.1, Table 1609.3.1, 1609.4, 1609.7.3, 1612.1.3, 1612.2, 1614.1, 1615.1, 1615.2, 1618.4.8, 1618.9, 1619.1, 1619.2.1, 1619.2.2, 1620.1, 1621.1, 1622.1.1, 1626.1, 2002.6
8—02	Standard Specification for the Design of Cold-formed Stainless Steel Structural Members	1604.3.3, 2209.1, 2214.3
11	Guidelines for Structural Condition Assessment of Existing Buildings	1920.3, 2003.2, 2214.3
19—96	Structural Applications of Steel Cables for Buildings	2207.1, 2207.2
24—05	Flood Resistant Design and Construction	1203.3.2, 1612.4, 1612.5, 3001.2
29—05	Standard Calculation Methods for Structural Fire Protection	721.1
32—01	Design and Construction of Frost Protected Shallow Foundations	1805.2.1

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1719 Tullie Circle NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
52.1—92	Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter ASHRAE Handbook—HVAC Applications	Table 13-420.3.13.7
62—01	Ventilation for Acceptable Indoor Air Quality	Table 13-420.3.13.7

ASME

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
A17.1-1990		11-4.10
A 17.1—04	Safety Code for Elevators and Escalators includes A17.1a in 2005 Addenda	1607.8.1, 3001.1, 3001.2, 3001.4, 3002.5, 3003.2, 3008.1, 3010.1, 3011.1
A17.1S-05	Supplement to Safety Code for Elevators and Escalators	3001.2
A 17.3—96	Safety Code for Existing Elevators and Escalators	3001.1, 3001.2
A18.1—03	Safety Standard for Platform Lifts and Stairway Chairlifts	3001.1, 3001.2
A90.1—03	Safety Standard for Belt Manlifts	3001.2

ASME - continued

A112.18.19.8M—1987	Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs and Whirlpool Bathing Appliances	3109.5.1
A112.19.17—2002	Manufactured Safety Vacuum Release Systems (SVRS) for Residential and Commercial Swimming Pool, Spa, Hot Tub and Wading Pool	3109.5.2
A 120.1—01	Safety Requirements for Powered Platforms for Building Maintenance	3001.6
A 924/A924M-99	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process	2319.19.2.2.7
B16.18—2001	Cast Copper Alloy Solder Joint Pressure Fittings	909.13.1
B16.22—2001	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	909.13.1
B 18.6.1-97	Wood Screws (Inch Series)	1506.6
B20.1—2003	Safety Standard for Conveyors and Related Equipment	3001.2, 3005.3
B31.3—2002	Process Piping	415.8.6.1

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in code section number
01760—76	Standard Specification for Pressure Treatment of Timber Products	Table 1823
A 6/A 6M— 04a	Specification for General Requirements for Rolled Steel, Structural Steel Bars, Plates, Shapes, and Sheet Piling	2214.3
A 29	Standards for General Requirements for Hot-Rolled and Cold-Finished Carbon and Alloy Steel Bars	1827.1
A 36/A 36M–04	Specification for Carbon Structural Steel	1809.3.1, 2103.13.5
A 82–02	Specification for Steel Wire, Plain, for Concrete Reinforcement	2103.13.5, 2103.13.6
A 123/A 123m–02	Specification for Zinc (Hot-dip Galvanized) Coating on Iron and Steel Products	2103.13.7.2
A 153–03	Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware	2103.13.7.2, 2304.9.5
A 185–02	Specification for Steel Welded Wire Reinforcement, Plain for Concrete	2103.13.4, 2103.13.5
A 240–04	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications	Table 1507.4.3(1), 2103.13.5
A 252—98 (2002)	Specification for Welded and Seamless Steel Pipe Piles	1809.3.1, 1810.6.1, 1826.1.5.3
A 283/A 283M–03	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	1809.3.1, 1810.6.1
A 306	Carbon Steel Bars Subject to Mechanical Property Requirements	1827.1
A 307–03	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength	1911.1, 2103.13.5
A 325—94	Specification for Structural Bolts, Steel, Heat-Treated, 120/105 Ksi Minimum Tensile Strength	2214.3
A 361	Specification for Steel Sheet Zinc-Coated (Withdrawn)	2319.17.1.1
A 416/A 416M–02	Specification for Steel Strand, Uncoated Seven-wire for Prestressed Concrete	1809.2.3.1, 2103.13.6
A 421/A 421M—02	Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete	1922.4.2, 2103.11.6
A 435/A 435M–90 (2001)	Specification for Straight-beam Ultrasonic Examination of Steel Plates	1708.4
A 446	Specification for Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality	1917.4.4
A 463/A 463M–02a	Specification for Steel Sheet, Aluminum-coated, by the Hot Dip Process	Table 1507.4.3(2)
A 480/A 480M–02	Specification for General Requirements for Flat-rolled Stainless and Heat-resisting Steel Plate, Sheet, and Strip	2103.13.5
A 490—93	Specification for Heat-Treated, Steel Structural Bolts, 150 ksi Minimum Tensile Strength	2214.3
A 496–02	Specification for Steel Wire, Deformed for Concrete Reinforcement	2103.13.3
A 497–01	Specification for Steel Welded Reinforcement Deformed, for Concrete	2103.13.4
A 510–03	Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel	2103.13.6
A 525—87	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process	1917.4.4, 2214.3, 2517.2, 2517.5.1, 2517.5.4
A 568/A 568M–03	Specification for Steel, Sheet, Carbon, and High-strength, Low-alloy, Hot-rolled and Cold-rolled, General Requirements for	Table 1704.3
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‖	D 2843—99(2004)	Test for Density of Smoke from the Burning or Decomposition of Plastics 2606.4, 2612.2
	D 2850–03a	Test Method for Uncolsolidated, Undrained Triaxial Compression Test on Cohesive Soils 1613.5.5
‖	D 2856	Standard Test Method for Open-cell Content of Rigid Cellular Plastics by the Air-Pycnometer. 523.6.5.2.17.5
‖	D 2898—94 (1999)	Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 1505.1, 1516.1, 2303.2.1, 2303.2.3, 2314.4.4, 2327.4, 2329.1
‖	D 2922	Standard Test Method for Density of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth) 1820.3.2
‖	D 3018	Standard for Specification for Class A Asphalt Shingles Surfaced with Mineral Granules 1523.6.5.1
	D 3019–e01 (Supp)	Specification for Lap Cement Used with Asphalt Roll Roofing, Nonfibered, Asbestos Fibered and Nonasbestos Fibered ..... Table 1507.10.2
	D 3161–03b	Test Method for a Wind Resistance of Asphalt Shingles (Fan Induced Method) 1504.1.1, 1507.2.5
	D 3200–74 (2000)	Standard Specification and Test Method for Establishing Recommended Design Stresses for Round Timber Construction Poles 2303.1.11
‖	D 3201—94 (1998) el	Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Base Products 2303.2.4, 2314.4.4, 2327.5
	D 3201–94 (2003)	Test Method for Hygroscopic Properties of Fire-retardant-treated Wood and Wood-based Products 2303.2.4
	D 3278–96e01	Test Methods for Flash Point of Liquids by Small Scale Closed-cup Apparatus 307.2
‖	D 3441	Static Cone Soundings 1834.3.3
‖	D 3462—04	Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules 1507.2.5, 1523.6.5.1
	D 3468–99	Specification for Liquid-applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing 1507.15.2
‖	D 3498—03	Standard Specifications for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems. . . 2314.4.4, 2322.1.5
‖	D 3679—05	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding 1404.9, 1405.13
	D 3689–90 (1995)	Method for Testing Individual Piles Under Static Axial Tensile Load 1808.2.8.5
‖	D 3737—05	Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam) 2303.1.3
‖	D 3746—85 (2002) el	Test Method for Impact Resistance of Bituminous Roofing Systems 1504.7, 1515.2.4
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	D 3909–97b	Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules. . . 1507.2.9.2, 1507.6.4, Table 1507.10.2
	D 3957–03	Standard Practices for Establishing Stress Grades for Structural Members Used in Log Buildings 2303.1.10
	D 4022–94 (2000)e01	Specification for Coal Tar Roof Cement, Asbestos Containing ..... Table 1507.10.2
‖	D 4272—03	Test Method for Total Energy Impact of Plastic Films by Dart Drop 1504.7, 1515.2.4
‖	D 4402	Viscosity Determinations of Unfilled Asphalt Using the Brookfield Thermoset Apparatus 1519.2.3
	D 4318–00	Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils 1613.5.5, 1802.3.2
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‖	D 4477-04a	Standard Specification for Rigid (Unplasticized) Poly (Vinyl Chloride) (PVC) Siding 1404.9, 1404.9.1, 1405.13
	D 4479–00	Specification for Asphalt Roof Coatings–Asbestos-free ..... Table 1507.10.2
	D 458–00	Specification for Asphalt Roof Cement, Asbestos-free ..... Table 1507.10.2
	D 4601–98	Specification for Asphalt-coated Glass Fibr Base Sheet Used in Roofing ..... Table 1507.10.2
	D 4637–04	Specification for EPDM Sheet Used in Single-ply Roof Membrane 1507.12.2
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	D 4897–01	Specification for Asphalt-coated Glass Fiber VEnting Base Sheet Used in Roofing ..... Table 1507.10.2
	D 4945–00	Test Method for High-strain Dynamic Testing of Piles 1808.2.8.3
	D 4990–97a	Specification for Coal Tar Glass Felt Used in Roofing and Waterproofing ..... Table 1507.10.2
	D 5019–96e01	Specification for Reinforced Nonvulcanized Polymeric Sheet Used in Roofing Membrane 1507.12.2
‖	D 5034—95	Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test) 24.2.17.1.15
‖	D 5055—04	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-joists. . . 424.2.14.1.15, 2303.1.2
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	D 5516–03	Test Method of Evaluating the Flexural Properties of Fire-retardant treated Softwood Plywood Exposed to the Elevated Temperatures 2303.2.2.1
	D 5643–94 (2000)e01	Specification for Coal Tar Roof Cement, Asbestos-free ..... Table 1507.10.2
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D 6162–00A	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements ... 1507.11.2
D 6163–00 E01	Specification for Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet Metal Materials Using Glass Fiber Reinforcements ... 1507.11.2
D 6164–00	Specification for Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet Metal Materials Using Polyester Reinforcements ... 1507.11.2
D 6222–02	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements ... 1507.11.2
D 6223–02	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements ... 1507.11.2
D 6298–00	Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface ... 1507.11.2
D 6305–02e01	Practice for Calculating Bending Strength Design Adjustment Factors for Fire-retardant-treated Plywood Roof Sheathing ... 2303.2.2.1
D 6380-01	Specifications for Asphalt Roll Roofing (Organic Felt) ... 1507.3.3
D 6381–03	Standard Test Method for Measurement of Asphalt Shingle Mechanical Uplift Resistance . 1504.2.1, Table 1504.2.1, 1609.5.2
D 6694–01	Standard Specification for Liquid-applied Silicone Coating Used in Spray Polyurethane Foam Roofing ... 1507.15.2
D 6754–02	Standard Specification for Ketone Ethylene Ester Based Sheet Roofing ... 1507.13.2
D 6757–02	Standard Specification for Inorganic Underlayment for Use with Steep Slope Roofing Products ... 1507.2.3
D 6841-03	Standard Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber ... 2303.2.2.2
D 6878–03	Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing ... 1507.13.2
D 7158-05	Standard Test Method for Wind Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method) ... Table 1507.2.10
E 72–02	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction ... 2103.11.1
E 84—04	Test Method for Surface Burning Characteristics of Building Materials ... 402.10, 402.14.4, 406.5.2, 410.3.5.3, 422.2.16.3, 423.11.5, 703.4.2, 719.1, 719.4, 802.1, 803.1, 803.5, 803.6.1, 803.6.2, 1407.10, 1407.10.1, 2303.2, 2314.4.4, 2327.1, 2603.3, 2603.4.1.13, 2603.5.4, 2604.2.4, 2606.4, 2612.2, 2612.3
E 90–04	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements ... 1207.2
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E 136 2004	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C ... 703.4.1
E 163-84E01	Methods of Fire Tests For Window Assemblies (withdrawn) ... 2121.2.1.2.8
E 328–02	Methods for Stress Relaxation for Materials and Structures ... 2103.13.6
E 330—02	Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference ... 1714.5.3, 2415.4, 2415.7.1
E 331—00	Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference ... 1403.2, 2415.4
E 492–04	Test Method for Laboratory Measurement of Impace Sound Transmission Through Floor-ceiling Assemblies Using the Tapping Machine ... 1207.3
E 518–03	Standard Test Methods for Flexural Bond STrength of Masonry ... 2101.3.11.1
E 519–02	Standard Test Method for Diagonal Tension (Shear) in Masonry Assemblages ... 2103.11.1
E 605–00	Test Method for Thickness and Density of Sprayed Fire-resistive Material (SFRM) Applied to Structural Members ... 1704.10.3, 1704.10.3.1, 1704.10.3.2, 1704.10.4
E 681–04	Test Methods for Concentration Limits of Flammability of Chemical Vapors and Gases ... 307.2
E 736–00	Test Method for Cohesion/Adhesion of Sprayed Fire-resistive Materials Applied to Structural Members ... 1704.10.5
E 814–02	Test Method of Fire Tests of Through-penetration Firestops ... 702.1, 712.3.1.2, 712.4.1.1, 712.4.1.1.2
E 970–00	Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Usinsg a Radiant Heat Energy Source ... 719.3.1
E1300—04e01 or 98 (HVHZ)	Practice for Determining Load Resistance of Glass in Buildings ... 1714.5.2.1, 2404.1, 2404.2, 2404.3, 2411.2.1.1, 2411.2.1.2, 2411.3.1.2
E1592—01	Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference ... 1504.3.2, 2411.2.1.2
E 1602–03	Guide for Construction of Solid Fuel-burning Masonry Heaters ... 2112.2

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E 1886-02 or 05	Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials	202, 1609.1.4
E 1966 2003	Test Method for Fire-Resistant Joint Systems	202, 702.1, 712.3
E 1966–00	Test Method for Fire-resistant Joint Systems	702.1, 7.13.3
E 1996-02 or 05	Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors, and Storm Shutters Impact by Windborne Debris in Hurricanes	202, 1609.1.4
E 2307–04	Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-scale, Multistory Test Apparatus	713.4
F 547–01	Terminology of Nails for Use with Wood and Wood-based Materials	Table 2506.2
F 851—87 (2000)	Standard Test Method for Self-Rising Seat Mechanisms	1024.10
F 1346—91 (2003)	Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs	424.1.3.9, 424.2.2, 424.2.17
F 1667–03	Specification for Driven Fasteners: Nails, Spikes and Staples	Table 720.1(2), Table 720.1(3), 1507.2.6, 2303.6, Table 2506.2
F 2006–00	Standard/Safety Specification for Window Fall Prevention Devices for Nonemergency Escape (Egress) and Rescue (Ingress) Windows	1405.12.2
F2090–01a	Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms	1405.12.2
G 53—96	Practice for Operating Light-and Water-Exposure Apparatus (Fluorscent UV-Condensation Type) for Exposure of Nonmetallic Materials	424.17.1.15.2
G 60—01	Standard Practice for Conducting Cyclic Humidity Tests	2319.17.2.2.8
G 85	Standard Practice for Modified Salt Spray (Fog) Testing	1517.5.1, 1517.5.2, 1523.6.5.2.10, 1523.6.5.2.11
G 152–04	Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials	1504.6
G 154–00A	Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials	1504.6
G 155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials	2612.2
G 155–04	Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials	1504.6

AWCI

The Association of the Wall and Ceiling Industries International
803 West Broad Street, Suite 600
Falls Church, VA 22046

Standard reference number	Title	Referenced in code section number
12—B—98	Technical Manual 12-B Standard Practice for the Testing and Inspection of Field Applied This—Film Intumescent Fire-resistive Materials; an Annotated Guide, First Edition	1704.11

AWPA

American Wood-Preservers' Association
P.O. Box 5690
Grandbury, TX 76049

Standard reference number	Title	Referenced in code section number
C1—00	All Timber Products—Preservative Treatment by Pressure Processes	1505.6, 2303.1.8, 2314.4.5
C2—01	Lumber, Timber, Bridge Ties and Mine Ties—Preservative Treatment by Pressure Processes	Table 1507.9.5, 1805.4.5, 1805.7.1, 2303.1.8, 2304.11.2, 2304.11.4, 2304.11.7, 2314.4.5
C3—99	Piles—Preservative Treatment by Pressure Processes	1805.4.5, 1809.1.2, 1823.1.3, 2303.1.8, 2314.4.5
C4—99	Poles—Preservative Treatment by Pressure Processes	1805.7.1, 1808.1.2, 2303.1.8, 2314.4.5
C5	Posts - Pressure Treatment	2314.4.5
C6	Cross Ties and Switch Ties Pressure Treatment	2314.4.5
C7	Incised (Red, White & Alaska Yellow Cedar) Poles Butts Thermal Treatment	2314.4.5
C8	Poles (Western Red & Alaska Yellow Cedar) Full Length Thermal Treatment	2314.4.5
C9—00	Plywood—Preservative Treatment by Pressure Processes	2304.11.2, 2304.11.4, 2304.11.7, 2314.4.5
C10	Poles (Lodgepole Pine) Full Length Thermal Treatment	2314.4.5
C11	Wood Blocks for Floors & Platforms Pressure Treatment	2314.4.5
C14—99	Wood for Highway Construction, Pressure Treatment by Pressure Process	2314.4.5
C16—00	Wood Used on Farms, Pressure Treatment by Pressure Process	2314.4.5
C18—99	Standard for Pressure Treated Material in Marine Construction	2314.4.5
C20	Structural Lumber, Fire Retardant Pressure Treatment	2314.4.5

AWPA - continued

C22—96	Lumber and Plywood for Permanent Wood Foundations— Preservative Treatment by Pressure Processes	1805.4.6, 2314.4.5
C23—00	Round Poles and Posts Used in Building Construction— Preservative Treatment by Pressure Processes	2314.4.5
C25	Crossarms Pressure Treatment	2314.4.5
C26	Crossarms, Non-Pressure Treatment	2314.4.5
C28—99	Standard for Preservative Treatment by Pressure Process of Structural Glued Laminated Members and Laminations before Gluing	2314.4.5
C29	Lumber to be Used for the Harvesting, Storage and Transportation of Food Stuffs— Preservative Treatment by Pressure Processes	2314.4.5
M4—02	Standard for the Care of Preservative-Treated Wood Products	1823.1.4, 2314.4.5
M6—96	Brands Used on Forest Products	2315.1.9
U1—04	USE CATEGORY SYSTEM: User Specification for Treated Wood Except Section 6, Commodity Specification H	1403.5, 1505.6, Table 1507.9.5, 1805.4.5, 1805.4.6, 1805.7.1, 1809.1.2, 2303.1.8, 2304.11.2, 2304.11.4, 2304.11.6, 2304.11.7

AWS

American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

Standard reference number	Title	Referenced in code section number
B2.1	Standard Welding Procedure and Performance Qualification	2214.3
C5.4	Recommended Practice for Stud Welding	2214.3
D1.1—04	Structural Welding Code—Steel	2214.3
D1.2	Structural Welding Code—Aluminum	2003.3
D1.3—98	Structural Welding Code—Sheet Steel	2214.3
D1.4—98	Structural Welding Code—Reinforcing Steel	1903.5.2, 1922.4.4, 1922.4.5, 1926.4.6, 1926.4.8, 2119.1.1, 2214.3
D9.1	Specification for Welding of Sheet Metal	2214.3
D10.9	Standard for Qualification of Welding Procedures and Welders for Piping and Tubing	2214.3

BHMA

Builders Hardware Manufacturers' Association
355 Lexington Avenue, 17th Floor
New York, NY 10017-6603

Standard reference number	Title	Referenced in code section number
A 156.10—99	American National Standard for Power Operated Pedestrian Doors	1008.1.3.2
A 156.19—02	Standard for Power Assist and Low Energy Operated Doors	1008.1.3.2

CGSB

Canadian General Standards Board
222 Queens Street
14th Floor, Suite 1402
Ottawa, Ontario, Canada KIA 1G6

Standard reference number	Title	Referenced in code section number
37-GP-52M (1984)	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric	1504.7, 1507.12.2
CAN/CGSB 37.54—95	Polyvinyl Chloride Roofing and Waterproofing Membrane	1507.13.2
37-GP-56M (1980)	Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing— with December 1985 Amendment	1507.11.2

CPSC

Consumer Product Safety Commission
4330 East West Highway
Bethesada, MD 20814-4408

Standard reference number	Title	Referenced in code section number
16 CFR Part 1201(1977)	Safety Standard for Architectural Glazing Material	2406.1.1, 2406.2.1, 2407.1, 2408.2.1, 2408.3, 2411.1.3, 2411.3.1.3, 2411.4.2, 2612.4.8
16 CFR Part 1209 (1979)	Interim Safety Standard for Cellulose Insulation	719.6
16 CFR Part 1404 (1979)	Cellulose Insulation	719.6
16 CFR Part 1500 (1991)	Hazardous Substances and Articles; Administration and Enforcement Regulations	307.2
16 CFR Part 1500.44 (2001)	Method for Determining Extremely Flammable and Flammable Solids	307.2
16 CFR Part 1507 (2001)	Fireworks Devices	307.2
16 CFR Part 1630 (2000)	Standard for the Surface Flammability of Carpets and Rugs	804.4.1
Pub. No. 362	Safety Barrier Guidelines for Home Pools	424.1.3.1.9

CSA

Canadian Standards Association
5060 Spectrum Way, Suite 100
Mississauga, Ontario, L4W 5N6 Canada

Standard reference number	Title	Referenced in code section number
101/I.S.2/A440—05	Specifications for Windows, Doors and Unit Skylights	1714.5.1, 2405.5

CSSB

Cedar Shake and Shingle Bureau
P.O. Box 1178
Sumas, WA 98295-1178

Standard reference number	Title	Referenced in code section number
CSSB—97	Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau	Table 1507.8.4, Table 1507.9.5

DASMA

Door and Access Systems Manufacturers Association International
1300 Summer Avenue
Cleveland, OH 44115-2851

Standard reference number	Title	Referenced in code section number
107—98 (03)	Room Fire Test Standard for Garage Doors Using Foam Plastic Insulation	2603.4.1.9
108—02	Standard Method for Testing Sectional Garage Doors	1714.5.3.1
115-05	Standard Method for Testing Garage Doors and Rolling Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure	1609.1.4

DECO

Document Engineering Co., Inc.
5210 Stagg Street
Van Nuys, CA 91401

Standard reference number	Title	Referenced in code section number
ANSI Z 358.1 04	Emergency Eyewash and Shower Equipment	Table 420.3.17.2

DOC/NIST

U.S. Department of Commerce
National Institute of Standards and Technology
100 Bureau Drive Stop 3460
Gaithersburg, MD 20899

Standard reference number	Title	Referenced in code section number
CS236	Mat-Formed Particleboard	2314.4.6, 2315.1.6
PS1-95	Construction and Industrial Plywood	2211.2.2.2, 2303.1.4, 2304.6.2, Table 2304.7(4), 2306.3.2, 2314.4.6, 2315.1.2
PS2-92	Performance Standard for Wood Based Structural Use Panels	1809.1.1, 2211.3.1, 2303.1.4, 2304.6.2, Table 2304.7(4), Table 2304.7(5), Table 2306.3.1, 2306.3.2, 2314.4.6, 2315.1.2
PS20-99	American Softwood Lumber Standard	1809.1.1, 2302.1, 2303.1.1, 2314.4.6, 2315.1.8
PS56	Structural Glued Laminated Timber	2314.4.6

DOL/OSHA

U.S. Department of Labor
Occupational Safety and Health Administration
Frances Perkins Building
200 Constitution Avenue, N.W.
Washington, D.C. 20210

Standard reference number	Title	Referenced in code section number
29 CFR Part 1910.1000 (1974)	Air Contaminants	902.1
29CFR Part 1910	Occupational Safety and Health Standards	1618.4
29CFR 1926-950 (p)	Occupational Safety and Health Administration Excavation Safety Act	1817.1

DOT

U.S. Department of Transportation
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
14 CFR Part 150 (2005)	Airport Noise Compatibility Planning, Federal Aviation Administration	3113.1
49 CFR—1998	Specification of Transportation of Explosive and Other Dangerous Articles, UN 0335,UN 0336 Shipping Containers	307.2
49 CFR Parts 173.137 (1990)	Shippers—General Requirements for Shipments and Packaging—Class 8—Assignment of Packing Group	307.2

FC&PA

Florida Concrete & Products Association Inc.
3030 Dade Ave.
Orlando, Fla. 32804

Standard reference number	Title	Referenced in code section number
FC&PA—97	Guide to Concrete Masonry Residential Construction in High Wind Areas	1609.1.1

FEMA

Federal Emergency Management Agency
Federal Center Plaza
500 C Street S.W.
Washington, DC 20472

Standard reference number	Title	Referenced in code section number
44CFR59	Emergency Management and Assistance, General Provisions	423.4.2, 3110.1.2
44CFR60—97	Criteria for Land Management and Use	423.4.2, 3110.1.2
FIA-TB11—01	Crawlspace Construction for Buildings Located in Special Flood Hazard Areas	1807.1.2.1

FINA

Federation Internationale de Natation Amateur
Av. de l' Avant-Poste 4
1005 Lausanne
SWITZERLAND

Standard reference number	Title	Referenced in code section number
CHG-22	FINA Handbook 1998-2000	424.1.2.7

Florida Codes

Florida Building Commission
Building Codes and Standards
Department of Community Affairs
2555 Shumard Oak Blvd.
Tallahassee, FL 32399-2100

Standard reference number	Title	Referenced in code section number
Ch. 11 FBC-B—07	Ch. 11, Florida Building Code, Building (Florida Accessible Code for Building Construction)	101.4.8, 104.11.3, 201.5, 403.1.1, 406.2.2, 412.1.6, 423.10.2.8.7, 423.27.4, 423.28.2.4, 427.1.4.1.1.3, 427.1.4.4.1, 427.1.4.4.2, 1003.3.4, 1003.5.3, 1007.1, 1008.1, 1009.5.3, 1009.11.8, 1009.14, 1010.1, 1010.8, 1010.9, 1208.2, 3001.3
Ch. 13 FBC-B—07	Ch. 13 Florida Building Code, Building (Energy Efficiency)	101.4.7, 201.6, 1202.3.2, 1301.1.1, 1403.2
Ch. 27 FBC-B—07	Ch. 27 Florida Building Code, Building (Electrical Systems)	101.4.1, 102.2.6, 107.3, 414.5.4, 414.9.2.8.1, 415.9.2.8, 419.3.8.3, 419.3.8.8, 419.3.14.2, 419.3.14.4, 419.3.15.2, 420.3.19.3, 420.3.19.5, 420.3.20.2, 420.3.20.3, 421.3.9.3, 421.3.9.5, 421.3.10.10, 423.25.5, 423.25.5.2, 424.1.4.1, 424.1.6.5.16.4.1, 424.1.6.5.1, 424.1.9.8.5, 424.2.16, 425.3.5, 426.3.5, 427.1.4.1.5, 603.1.3, 904.3.1, 907.1.3, 907.5, 907.9.3, 909.11, 909.12.1, 909.16.3, 1006.2.3.4, 1006.2.4, 1205.4.1, 1405.10.4, 2701.1, 2702.1
FEBC—07	Florida Existing Building Code	101.2. 1009.3
FPC—07	Florida Fire Prevention Code	101.4.6, 102.6, 201.3, 307.2, Table 307.7(1), Table 307.7(2), 307.9, Table 307.7(1), Table 307.7(2), 307.9, 308.2, 308.3, 404.2, 406.5.1, 406.5.2, 406.6.1, 410.3.6, 411.1, 412.4.1, 413.1, 414.1.1, 414.1.2, 414.1.2.1, 414.2.4, Table 414.2.4, 414.3, 414.5, 414.5.1, Table 414.5.1, 414.5.2, 414.5.4, 414.5.5, 414.6, 415.1, 415.3, 415.3.1, Table 415.3.1, Table 415.3.2, 415.7, 415.7.1, 415.7.1.4, 415.7.2, 415.7.2.3, 415.7.2.5, 415.7.2.7, 415.7.2.8, 415.7.2.9, 415.7.3, 415.7.3.3.3, 415.7.3.5, 415.7.4, 415.8, 415.9.1, 415.9.2.7, 415.9.5.1, 415.9.7.2, 704.8.2, 706.1, 901.2, 901.3, 901.5, 901.6.2, 903.2.6.1, 903.2.11, Table 903.2.13, 903.5, 904.2.1, 905.1, 906.1, 907.2.5, 907.2.12.2, 907.2.14, 907.2.16, 907.19, 909.20, 910.2.3, Table 910.3, 1001.3, 1203.4.2, 1203.5, 2702.2.8, 2702.2.10, 2702.2.11, 2702.2.12, 2702.3, 3102.1, 3103.1, 3309.2
FBC-FG—07	Florida Building Code, Fuel Gas	101.4.2, 109.3, 201.1, 201.3, 415.7.3, 424.2.1.2, 424.2.15, 425.3.7, 426.6.1, 426.3.6.2, 2113.11.1.2, 2113.15, 2801.1
FBC-M—07	Florida Building Code, Mechanical	101.4.3, 201.3, 202, 307.9, 406.4.2, 406.6.3, 406.6.5, 409.3, 412.4.6, 414.1.2, 414.1.2.1, 414.1.2.2, 414.3, 415.7.1.4, 415.7.2, 415.7.2.8, 415.7.3, 415.7.4, 415.9.11.1, 416.3, 603.1, 707.2, 716.2.2, 716.5.4, 716.6.1, 716.6.2, 716.6.3, 717.5, 719.1, 903.2.12.1, 904.2.1, 904.11, 908.6, 909.1, 909.10.2, 1014.5, 1016.4.1, 1203.1, 1203.2.1, 1203.4.2, 1203.4.2.1, 1203.5, 1209.3, 2304.5, 3004.3.1
FBC-P 07	Florida Building Code, Plumbing	101.4.4, 109.3, 201.3, 415.7.4, 419.3.13.1, 421.3.8.1, 424.2.1.2, 424.2.3, 424.2.8.1, 424.2.13.2, 425.4.2, 426.3.1.2, 426.3.2.1, 427.1.4.1.2, 430.6.1, 603.1.2, 717.5, 903.3.5, 1206.3.3, 1503.4, 1503.4.3, 151.4.2, 1514.4.3, 1807.4.3, 2901.1, 2902.1.1, 3305.1
61C-5	Rule 61C, Florida Administrative Code (Bureau of Elevator Safety Regulations),	3001.1
64E	Rule 64E, Florida Administrative Code (Sewage Disposal)	101.4.4, 2901.1
FBC-R—07	Florida Building Code, Residential	101.2, 308.3, 308.5, 310.1, 1706.1.1
FBC-TPHVHZ—07	Florida Building Code, Test Protocols for High Velocity Hurricane Zones	
	RAS 109	1521.18, 1523.6.2.1
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RAS 130 ..... 1518.10
RAS 133 ..... 1519.9.2
RAS 150 ..... 1519.1
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TAS 102 ..... 1523.6.5.2.3, 1523.6.5.2.3.2, 1523.6.5.2.3.3, 1523.6.5.2.6.2, 1523.6.5.2.6.3
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TAS 116 ..... 1513.1, 1523.6.5.2.2.1, 1523.6.5.2.3.1, 1523.6.5.2.6.1
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TAS 124 ..... 1521.10, 1523.6.4
TAS 125 ..... 1518.9.1, 1523.6.5.2.4.1
TAS 126 ..... 1521.12
TAS 135 ..... 1523.6.5.2.6
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TAS 203 ..... 202, 1609.1.4
TAS 301 ..... 1515.1.3

FM

Factory Mutual
Standards Laboratories Department
1151 Boston-Providence Turnpike
Norwood, MA 02062

Standard reference number	Title	Referenced in code section number
4450 (1992)	Approval Standard for Class 1 Insulated Steel Deck Roofs—with Supplements through July 1992	1504.3.1, 1508.1, 2603.3, 2603.4.1.5, 2612.3.2.5.2
4471	Approval Standard for Class I Panel Roofs	1515.1.1
4880 (2001)	American National Standard for Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies, Plastic Interior Finish Materials, Plastic Exterior Building Panels, Wall/Ceiling Coating Systems, Interior and Exterior Finish Systems	2603.4, 2603.9

FRSA

Florida Roofing, Sheet Metal and
Air Conditioning Contractors Association
4111 Metric Drive
Winter Park, Florida 32792

Standard reference number	Title	Referenced in code section number
FRSA/TRI 07320/8-05	Concrete and Clay Roof Tile Installation Manual, Fourth Edition	1507.3.3, 1507.3.7, 1507.3.8, 1507.3.9

GA

Gypsum Association
810 First Street N.E. #510
Washington, DC 20002-4268

Standard reference number	Title	Referenced in code section number
GA 216—04	Application and Finishing of Gypsum Board	Table 2508.1, 2509.2
GA 600—03	Fire-Resistance Design Manual, 17th Edition	Table 720.1(1), Table 720.1(2), Table 720.1(3)

GSA

General Services Administration
1800 F Street, NW
Washington, DC 20405

Standard reference number	Title	Referenced in code section number
DD-G-451D (1977)	Glass, Flat and Corrugated for Glazing Mirrors and Other Uses	2411.1.2

HPVA

Hardwood Plywood Veneer Association
1825 Michael Faraday Drive
Reston, VA 20190-5350

Standard reference number	Title	Referenced in code section number
HP-1—2000	The American National Standard for Hardwood and Decorative Plywood	2303.3, 2304.6.2

ICC

International Code Council
500 New Jersey Avenue, NW
Washington, D.C. 20001

Standard reference number	Title	Referenced in code section number
IBHS-05	Guideline for Hurricane Resistant Residential Construction with errata for the first printing.	1609.1.1, 1609.1.1.1, 2308.2.1
ICC/ANSI A117.1—03	Accessible and Usable Buildings and Facilities	406.2.2, 907.9.1.4,1007.6.5, 1010.1, 1010.6.5, 1010.9, 1011.3, 1101.2, 1102.1, 1103.2.14, 1106.7, 1107.2, 1108.2.2, 1109.1, 1109.2, 1109.2.1.1, 1109.2.2, 1109.3, 1109.4, 1109.8, 3001.3, 3409.6, 3409.8.2, 3409.8.3
ICC 300—02	ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands	1025.1.1, 3401.1
SBCCI SSTD 11—97	Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles	1715.2.1, 1715.2.2
SBCCI SSTD 12—99	Standard for Determining the Wind Resistance from Windborne Debris	423.25.4, 423.25.4.1, 1609.1.2

ISO

International Standards Organization
ISO Central Secretariat1, rue de Varembee, Case postale 56
CH-1211 Geneva 20, Switzerland

Standard reference number	Title	Referenced in code section number
ISO 8115—86	Cotton Bales–Dimensions and Density	Table 415.8.2.1.1

NAAMM

National Association of Architectural Metal Manufacturers
8 South Michigan Ave
Chicago, IL 60603

Standard reference number	Title	Referenced in code section number
FP 1001—97	Guide Specifications for Design of Metal Flag Poles	1609.1.1

NCMA

National Concrete Masonry Association
2302 Horse Pen Road
Herndon, VA 22071-3499

Standard reference number	Title	Referenced in code section number
TEK 5-84 (1996)	Details for Concrete Masonry Fire Walls	Table 720.1(2)

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269-9101

Standard reference number	Title	Referenced in code section number
10–02	Standard for Portable Fire Extinguisher	419.4.2.10.2, 420.4.2.10.1.2, 423.28.2.14
11—2005	Low Expansion Foam	904.7
12—2005	Carbon Dioxide Extinguishing Systems	904.8, 904.11 903.3.5.1.1, 904.11, 907.8, 1621.3.10.1, 2121.2.12.8, 3104.5, 3104.9
12A–04	Halon 1301 Fire Extinguishing Systems	904.9
13–02	Installation of Sprinkler Systems	707.3, 903.3.1.1, 903.3.2, 903.3.5.1.1, 903.3.5.2, 904.11, 905.3.4, 907.8, 3104.5, 3104.9
13D—02	Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes	903.3.1.3, 903.3.5.1.1
13R—02	Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height	903.3.1.2, 903.3.5.1.1, 903.3.5.1.2, 903.4
14—03	Installation of Standpipe and Hose System	905.2, 905.3.4, 905.4.2, 905.8
16—03	Installation Foam-water Sprinkler and Foam-water Spray Systems	904.7, 904.11
17—02	Dry Chemical Extinguishing Systems	904.6, 904.11
17A—02	Wet Chemical Extinguishing Systems	904.5, 904.11
30—03	Flammable and Combustible Liquids Code	415.3, 423.20.4.1
31—01	Installation of Oil-burning Equipment	2113.15
32—00	Dry Cleaning Plants	415.6.4
40—01	Storage and Handling of Cellulose Nitrate Film	409.1
61—02	Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities	415.7.1, 423.7.7
70—05	National Electric Code (Excluding Article 80)	2701.1
72—02	National Fire Alarm Code	423.7.7, 436.7.1.1, 436.7.1.3, 416.7.2, 436.10.5.1, 436.10.5.2, 505.4, 901.6, 903.4.1, 904.3.5, 907.2, 907.2.1, 907.2.1.1, 907.2.10, 907.2.10.4, 907.2.11.2, 907.2.11.3, 907.2.12.2.3, 907.2.12.3, 907.4, 907.5, 907.9.2, 907.10, 907.14, 907.16, 907.17, 911.1, 1008.1.3.7.4, 3002.8, 3006.5
80—99	Fire Doors and Fire Windows	508.2.2.1, 715.4, 715.4.5, 715.4.6.1, 715.4.7.2, 715.5, 1008.1.3.3
85—04	Boiler and Combustion System Hazards Code (Note: NFPA 8503 has been incorporated into NFPA 85)	415.6.1
92B—05	Smoke Management Systems in Malls, Atria and Large Spaces	909.8
91—99	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and NonCombustible Particulate Solids	423.20.4.1
96	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations	436.6.2
99—02	Standard for Health Care Facilities	4203.18.1, 420.3.20.2, 420.3.25.1,419.3.18, 419.3.18.8
101—06	Life Safety Code	420.3.3.6, 423.6.1, 423.14.2.1, 423.27.9.1, 423.27.10.1, 427.2.2.1.1.1, 427.1.4.13.2, 427.1.4.2.13, 427.1.4.1.1.2, 427.1.3.1.1.2, 903.6.2, 1024.6.2
105—03	Standard for the Installation of Smoke Door Assemblies	405.4.2, 715.4.3.1, 909.20.4.1
110—05	Emergency and Standby Power Systems	419.3.18, 419.3.18.8, 420.3.25, 1006.2.33, 421.3.13.1 1006.2.3.3, 2702.1
111—05	Stored Electrical Energy Emergency and Standby Power Systems	1006.2.3.3, 2702.1

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120—99	Coal Preparation Plants	415.6.1
211—03	Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances	2112.5
230—03	Standard for the Fire Protection of Storage	507.3
252—03	Standard Methods of Fire Tests of Door Assemblies	715.3, 715.4.1, 715.4.2, 715.4.3, 715.4.4.1
253—06	Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source	402.11.1, 406.6.4, 804.2, 804.3
257—00	Standard for Fire Test for Window and Glass Block Assemblies	715.3, 715.4.3.2, 715.5, 715.5.1, 715.5.2, 715.5.8.1
259—04	Test Method for Potential Heat of Building Materials	2603.4.1.10, 2603.5.3, 2612.3.2.4.4
265—02	Method of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings on Full Height Panels and Walls	803.6.2, 803.6.2.1
268—01	Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source	1406.2.1, 1406.2.1.1, 1406.2.1.2, 2603.5.7
285—98	Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components	1407.10.4, 2603.5.5
286—00	Standard Method of Fire Test for Evaluating Contribution of Wall and *Ceiling Interior Finish to Room Fire Growth*	402.15.4, 803.2, 803.2.1, 803.5, 803.6.3, 2603.4, 2603.9
288—01	Standard Methods of Fire Tests of Floor Fire Door Assemblies in Fire-resistance-rated Floor Systems	711.8, 712.4.1.5
303—06	Fire Protection Standards for Marinas and Boatyards	905.3.7
409—01	Aircraft Hangars	412.2.6, 412.4.5
418—01	Standard for Heliports	412.5.5
484—02	Combustible Metals, Metal Powders and Metal Dust	415.6.1
654—06	Prevention of Fire & Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids	415.6.1
655—01	Prevention of Sulfur Fires and Explosions	415.6.1
664—02	Prevention of Fires Explosions in Wood Processing and Woodworking Facilities	415.6.1
701—04	Standard Methods of Fire Tests for Flame-propagation of Textiles and Films	402.11.1, 410.3.6, 801.1.2, 806.1, 806.1.2, 806.2, 3102.3, 3102.3.1, 3102.6.1.1, 3105.4
704—01	Standard System for the Identification of the Hazards of Materials for Emergency Response	414.7.2, 415.2
780—97	Installation of Lighting Systems	419.3.19, 420.3.26.1, 423.17.7
1124—06	Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles	415.3.1
2001—04	Clean Agent Fire Extinguishing Systems	904.10

NRCA

National Roofing Contractors Association
10255 W. Higgins Road, Suite 600
Rosemont, IL 60018

Standard reference number	Title	Referenced in code section number
P0405	Roofing and Waterproofing Manual, 5th Edition	1513.1

NSPI

National Spa and Pool Institute
2111 Eisenhower Avenue
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
ANSI/NSF	International Standard 50-1996, Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs	424.1.6.5.1, 424.1.6.5.2, 424.1.6.5.16, 424.1.6.5.16.4.2, 424.1.6.5.16.5.2, 424.1.9.2.5.2
ANSI/NSPI 3—99	American National Standard for Permanently Installed Residential Spas	424.2.6.1
ANSI/NSPI 4—99	American National Standard for Aboveground/Onground Residential Swimming Pools	424.2.6.1
ANSI/NSPI 5—03	American National Standard for Residential Inground Swimming Pools	424.2.6.1
ANSI/NSPI 6—92	American National Standard for Residential Portable Spas	424.2.6.1
ANSI/NSPI 7—06	American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins	424.2.6

PCA

Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

Standard reference number	Title	Referenced in code section number
EB008-9	Concrete Masonry Handbook	2119.1.1

PCI

Precast Prestressed Concrete Institute
209 West Jackson Boulevard, Suite 500
Chicago, IL 60606-4938

Standard reference number	Title	Referenced in code section number
MNL 124—89	Design for Fire Resistance of Precast Prestressed Concrete	721.2.3.1
MNL 128—01	Recommended Practice for Glass Fiber Reinforced Concrete Panels	1903.2

PTI

Post-Tensioning Institute
1717 W. Northern Avenue, Suite 114
Phoenix, AZ 85021

Standard reference number	Title	Referenced in code section number
PTI—2004	Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils, First Edition	1805.8.2
PTI—2004	Standard Requirements for Design of Shallow Post-tensioned Concrete Foundation on Expansive Soils	1805.8.2

RCSC

Research Council on Structural Connections
c/o Stanley D. Lindsey & Assoc. Ltd.
2244 Metro Center Blvd., Suite 208
Nashville, TN 37228-1320

Standard reference number	Title	Referenced in code section number
RCSC—88	Specification for Structural Joints Using ASTM A 325 or A 490 Bolts	2214.3

RMI

Rack Manufacturers Institute
8720 Red Oak Boulevard, Suite 201
Charlotte, NC 28217

Standard reference number	Title	Referenced in code section number
RMI (2002)	Specification for Design, Testing and Utilization of Industrial Steel Storage Racks	2208.1
10100	Manual of Safety Practices - A Code of Practices for the Use of Industrial and Commercial Steel Storage Racks	2214.3
10150	Industrial Steel Storage Racks Manual	2214.3
10083	Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks	2208.1

SDI

Steel Deck Institute
PO Box 25
Fox River Grove, IL 60021

Standard reference number	Title	Referenced in code section number
DDP	Deck Damage and Penetrations	2214.3
DDM—02	Diaphragm Design Manual	2214.3, 2222.4
Number 30	Design Manual For Composite Decks, Form Decks and Roof Decks	2214.3
MOC1	Manual of Construction with Steel Deck	2214.3
SPD2	Standard Practice Details	2214.3

SDI

Steel Door Institute
c/o Wherry Associates
30200 Detroit Road,
Cleveland, Ohio 44145-1967

Standard reference number	Title	Referenced in code section number
ANSI A250.13—03	Testing and Rating of Severe Windstorm Resistant Components For Swinging Door Assemblies	1609.1.4.2, 1714.5.3.3.2

SFPA

Southern Forest Products Association
PO Box 641700
Kenner, LA 70064-1700

Standard reference number	Title	Referenced in code section number
2001	Permanent Wood Foundations: Design and Construction Guide (Replaces AF&PA Technical Report No. 7)	2314.4.7

SFPE

Society of Fire Protection Engineers
7315 Wisconsin Avenue, Suite 620E
Bethesda, MD 20814

Standard reference number	Title	Referenced in code section number
SFPE	Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings	104.11

SJI

Steel Joist Institute
3127 10th Avenue, North
Myrtle Beach, SC 29577-6760

Standard reference number	Title	Referenced in code section number
JG-1.1—05	Standard Specification for Joist Girders	1604.3.3, 2206.1
K-1.1—05	Standard Specification for Open Web Steel Joists, K-Series	1604.3.3, 2206.1
LH/DLH-1.1—05	Standard Specification for Longspan Steel Joists, LH Series and Deep Longspan Steel Joists, DLH Series	1604.3.3, 2206.1
SJI—71	Structural Design of Steel Joist Roofs to Resist Ponding Loads, Technical Digest No. 3	2214.3
SJI—88	Vibration of Steel Joist-Concrete Slab Floors, Technical Digest No. 5	2214.3
SJI—03	Structural Design of Steel Joist Roofs to Resist Uplift Loads, Technical Digest No. 6	2214.3
SJI—83	Welding of Open Web Steel, Technical Digest No. 8	2214.3
SJI—87	Handling and Erection of Steel Joists and Joist Girders, Technical Digest No. 9	2214.3
SJI—02	Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders	1604.3.3, 2206, 2214.3
SJI—03	75-Year Steel Joist Manual	2214.3

SMA

Storage Equipment Manufacturers Association
8720 Red Oak Blvd, Suite 201
Charlotte, NC 28217

Standard reference number	Title	Referenced in code section number
ANSI/SMA MH281—97	Specification of Industrial Grade Steel Shelving	2214.3

SMACNA

Sheet Metal and Air Conditioning Contractors' National Association
8224 Old Courthouse Rd.
Vienna, VA 22180

Standard reference number	Title	Referenced in code section number
SMACNA—2003	Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems	419.2.1.3, 420.2.3, 421.2.1.3
	Metal Roof and Wall Systems	RAS 133-9.2

SPRI

Single-Ply Roofing Institute
77 Rumford Ave.
Suite 3-B
Walthem, MA 02453

Standard reference number	Title	Referenced in code section number
ES-1—03	Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems	1503.3, 1504.5
RP-4—02	Wind Design Guide for Ballasted Single-ply Roofing Systems	1504.4

SSPC

The Society for Protective Coatings
40 24th Street, 6th Floor
Pittsburgh PA 15222-4656

Standard reference number	Title	Referenced in code section number
SSPC - Paint 15	Steel Joist Shop Paint	2214.3
SSPC/AISC	Guide to the Shop Painting of Structural Steel	2214.3

STI

Steel Tube Institute
522 Westgate Tower
Cleveland, OH 44116

Standard reference number	Title	Referenced in code section number
STI	Manual of Cold-Formed Welded Structural Steel Tube	2214.3

TECO

Timber Company, Inc.
2402 Daniels Street
Madison, WI 53704

Standard reference number	Title	Referenced in code section number
TECO PRP-133	Performance Standards and Policies for Structural Use Panels	2314.4.8, 2315.1.2

TIA

Telecommunications Industry Association
2500 Wilson Boulevard
Arlington, VA 22201-3834

Standard reference number	Title	Referenced in code section number
ANSI/TIA/EIA-222-G—05	Structural Standards for Steel Antenna Towers and Antenna Supporting Structures	1609.1.1, 3108.4

TMS

The Masonry Society
3970 Broadway, Unit 201-D
Boulder, CO 80304-1135

Standard reference number	Title	Referenced in code section number
0216—97	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies	Table 720.1(2), 721.1
402—05	Building Code Requirements for Masonry Structures	1405.5, 1405.5.2, 1405.9, 1604.3.4, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, Table 1703.4.5.3, 1708.1.1, 1708.1.2, 1708.1.3, 1708.1.4, 1805.5.2, 1812.7, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2106.1.1, 2106.1.1.1, 2106.1.1.2, 2106.1.1.3, 2106.3, 2106.4, 2106.5, 2106.6, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2107.6, 2107.7, 2107.8, 2108.1, 2108.2, 2108.3, 2108.4, 2109.1, 2109.2.3.1, 2109.7.3
602—05	Specification for Masonry Structures	1405.5.1, Table 1704.5.1, Table 1704.5.3, 2103.13.7, 2104.1, 2104.1.1, 2104.3, 2104.4

TPI

Truss Plate Institute
583 D'Onofrio Drive, Suite 200
Madison, WI 53719

Standard reference number	Title	Referenced in code section number
TPI 1—2002	National Design Standards for Metal-plate-connected Wood Truss Construction	2303.4, 2306.1, 2314.4.9, 2319.17.2.1.1, 2319.17.2.2.8
TPI/WTCA BCSI-06	Building Component Safety Information Guide to Good Practice for Handling, Installing, Restraining and Bracing of Metal Plate Connected Wood Trusses [A Joint publication with WTCA representing the Structural Building Components Industry]	2314.4.9, 2319.17.2.4.1, 2319.17.2.4.3

UL

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
9—00	Standard For Fire Tests of Window Assemblies	2121.2.12.8
10A—98	Tin Clad Fire Doors—with Revisions through March 2003	715.4
10B—97	Fire Tests of Door Assemblies—with Revisions through October 2001	715.4.2
10C—98	Positive Pressure Fire Tests of Door Assemblies—with Revisions through November 2001	715.4.1, 715.4.3
14B—98	Sliding Hardware for Standard Horizontally Mounted Tin Clad Fire Doors—with Revisions through July 2000	715.4
14C—99	Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs	715.4
94—96	Test for Flammability of Plastic Materials for Parts in Devices and Appliances	402.11.1
103—01	Factory-built Chimneys, for Residential Type and Building Heating Appliances	717.2.5
127—96	Factory-built Fireplaces—with Revisions through November1999	717.2.5, 2111.11
181—96	Standard for Factory-Made Air Ducts and Air Connectors	419.3.11.6
199E—04	Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers	904.11.4.1
217—97	Single and Multiple Station Smoke Alarms—with revisions through January 2004	907.2.10
268—96	Smoke Detectors for Fire Protective Signaling Systems—with Revisions through January 1999	407.6, 907.2.6.2
300—96	Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas — with Revisions through December 1998	904.11
555—99	Fire Dampers—with Revisions through January 2002	716.3
555C—96	Ceiling Dampers	716.3, 716.6.2
555S—99	Smoke Dampers—with Revisions through January 2002	716.3, 716.3.1.1
580—94	Test for Uplift Resistance of Roof Assemblies—with Revisions through February 1998	1504.3.1, 1504.3.2, 2214.3, 2222.4.6
641—95	Type L Low-temperature Venting Systems—with Revisions through April 1999	2113.11.1.4
710B—2004	Recirculating Systems	904.11
790—04	Tests for Fire Resistance of Roof Covering Materials—with Revisions through July 1998	1505.1, 1513.1, 1516.1, 1523.1.2, 2314.4.10, 2603.6, 2610.2, 2610.3
793—97	Standards for Automatically Operated Roof Vents for Smoke and Heat	910.3.1
864—03	Standards For Control Units and Accessories for Fire Alarm Systems—with Revisions through October 2003	909.12
924	Standard for Emergency Lighting and Power Equipment	1006.3.6
1040—96	Fire Test of Insulated Wall Construction—with Revisions through April 2001	1407.10.3, 2603.4, 2603.9
1256—02	Fire Test of Roof Deck Construction – with Revisions through March 2000	1508.1, 2603.3, 2603.4.1.5, 2612.3.2.5.2
1479—94	Fire Tests of Through-penetration Fire stops—with Revisions through August 2000	712.3.1.2, 712.4.1.1.2, 712.5
1482—98	Solid-fuel Type Room Heater—with Revisions through January 2000	2112.2, 2112.5
1715—97	Fire Test of Interior Finish Material—with Revisions through October 2002	1407.10.2, 1407.10.3, 2603.4, 2603.9
1777—04	Chimney Liners—with Revisions through July 1998	2113.11.1, 2113.19
1784—2001	Air Leakage Tests of Door Assemblies	707.14.1, 710.5.2, 715.4.3.1, 715.4.5.1, 715.4.5.3
1897—98	Uplift Tests for Roof Covering Systems—with Revisions through November 2002	1504.3.1
1975—96	Fire Test of Foamed Plastics Used for Decorative Purposes	402.10, 402.11.1, 402.15.5
2017—2000	Standards for General-purpose Signaling Devices and Systems—with Revisions through June 2004	3109.4.1.8
2079—98	Tests for Fire Resistance of Building Joint Systems	702.1, 713.3, 713.6

UL - continued

2200—98	Stationary Engine Generator Assemblies (Revisions through July 2004)	2702.1.1
2390—04	Test Method for Measuring the Wind Uplift Coefficients for Asphalt Shingles	1504.2.1, 1609.5.2

ULC

Underwriters Laboratories of Canada
7 Crouse Road
Scarborough, Ontario, Canada M1R3A9

Standard reference number	Title	Referenced in code section number
CAN/ULC S102.2—1988	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies with 2000 Revisions	719.4

USC

United States Code
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
18 USC Part 1, Ch.40	Importation, Manufacture, Distribution and Storage of Explosive Materials	307.2

WDMA

Window and Door Manufacturers Association
1400 East Touhy Avenue #470
Des Plaines, IL 60018

Standard reference number	Title	Referenced in code section number
101/I.S.2/A440—05	Specifications for Windows, Doors and Unit Skylights	1714.5.1, 2405.5

WPPC

Wood Products Promotional Council
c/o Florida Wood Council
1300 Limit Avenue
Mount Dora, FL 32758

Standard reference number	Title	Referenced in code section number
WWPC—97	Guide to Wood Construction in High Wind Areas	1609.1.1, 1609.1.1.1

WRI

Wire Reinforcement Institute, Inc.
203 Loudon Street, S.W.
2nd Floor, Suite 203C
Leesburg, VA 22075

Standard reference number	Title	Referenced in code section number
WRI/CRSI—81	Design of Slab-on-ground Foundations—with 1996 Update	1805.8.2

CHAPTER 36

FLORIDA FIRE PREVENTION CODE

SECTION 3601
GENERAL

3601.1 Scope. Provisions of this chapter shall govern the design, construction and arrangement of elements to provide a safe means of egress from buildings and structures and to minimize hazard to life and property due to fire and panic.

3601.2 In addition to the provisions of this code, buildings shall comply with the 2007 *Florida Fire Prevention Code* as adopted by the Florida State Fire Marshal.

APPENDIX A
EMPLOYEE QUALIFICATIONS

RESERVED

APPENDIX B

CHAPTER 9B-52 F.A.C.
FLORIDA STANDARD FOR PASSIVE RADON-RESISTANT CONSTRUCTION

NEW RESIDENTIAL BUILDING CONSTRUCTION

9B-52.001 Purpose and intent.

9B-52.002 Definitions.

9B-52.003 Department activities.

9B-52.004 Florida Standard for Passive Radon-Resistant New Residential.

Building construction, adopted.

9B-52.001 Purpose and intent.

1. The provisions of this rule chapter are adopted to implement the *Florida Standard for Passive Radon-Resistant New Residential Building Construction* as mandated in Part X, Chapter 553, *Florida Statutes*, in order to provide standards for construction of passive radon-resistant new residential buildings and to provide for the public safety, health and general welfare.
2. These rules and regulations prescribe standards for radon-resistant construction of new residential buildings in Florida. However, none of the provisions contained herein, or in the standards adopted, shall preclude or prohibit the owners of such buildings from exceeding these standards at their discretion.
3. Local jurisdictions may enact ordinances for radon-resistant new residential building construction providing that a county governing authority and the governing bodies of the municipalities representing at least a majority of the county's municipal population enter into an interlocal agreement to adopt by ordinance the department's standard as referenced in Section 9B-52.004(1). The standard shall apply uniformly to all jurisdictions that adopt the standard. No local jurisdiction may adopt any requirement for radon-resistant building construction other than the standard.

Specific 553.98(1), 553.98(2) FS.

Law Implemented 553.98 FS.

History–New 9-1-96.

9B-52.002 Definitions. For the purpose of this rule chapter, the following words, unless the context does not permit such meaning, shall have the meanings indicated:

1. Department–The Department of Community Affairs.
2. Exempted buildings–
   a. Buildings of occupancy classifications other than one- or two-family detached houses and town house apartments with no more than three stories (as distinguished from condominiums, apartments or commercial buildings that employ different construction practices).
   b. Residential buildings built on piers or pilings that elevate the bottom of the floor joists a minimum of 18 inches (457 mm) above grade and which comply with all requirements of Section 103.2(2) of the *Florida Standard for Passive Radon-Resistant New Residential Building Construction.*
3. New residential building–One- or two-family detached houses and town house apartments with no more than three stories (as distinguished from condominiums, apartments or commercial buildings that employ different construction practices) for which a building permit is issued on or after the effective date of these rules.
4. Radon–A naturally occurring, chemically inert, radioactive gas. It is part of the Uranium-238 decay series, and is the direct decay product of Radium-226.
5. Standard–The *Florida Standard for Passive Radon-Resistant New Residential Building Construction.*

Specific 553.98(1) FS.

Law Implemented 553.98 FS.

History–New 9-1-96.

9B-52.003 Department activities.

1. The department shall interpret and clarify various aspects of the *Florida Standard for Passive Radon-Resistant New Residential Building Construction.*
2. Any person may request information or interpretations regarding the application and administration of the standards adopted herein, provided that any oral request shall be confirmed by the party in writing to the department prior to the department's response.

Specific 553.98(1), 120.53(1)(a) FS.

Law Implemented 553.98 FS.

History–New 9-1-96.

9B-52.004 Florida Standard for Passive Radon-Resistant New Residential Building Construction, Adopted.

1. The *Florida Standard for Passive Radon-Resistant New Residential Building Construction,* dated July 1, 1995, is herein incorporated by reference.
2. A copy of the above referenced standard has been filed with these regulations with the Secretary of State. The standard is also available for reference and inspection at the Department of Community Affairs, Division of Housing and Community Development, Radon Program, 2740 Centerview Drive, Tallahassee, Florida 32399-2100.

Specific 553.98(1) FS.

Law Implemented 553.98 FS.

History–New 9-1-96.

FLORIDA STANDARD FOR PASSIVE RADON-RESISTANT NEW RESIDENTIAL BUILDING CONSTRUCTION

July 1, 1995

State of Florida
Florida Department of Community Affairs
Radon Program
2555 Shumard Oak Blvd
Tallahassee, FL 32399-2100
Linda Loomis Shelley, Secretary

Chapter	Description	Page No.
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	102 Intent	B.3
	103 Scope	B.3
	104 Compliance	B.3
TWO	DEFINITIONS	
	201 General	B.3
	202 Definitions	B.3
THREE	CONSTRUCTION REQUIREMENTS FOR PASSIVE RADON CONTROL	
	301 General	B.4
	302 Sub-slab and Soil Membranes	B.4
	303 Floor Slab-on-Grade Buildings	B.5
	304 Slab-Below-Grade Construction	B.6
	305 Buildings with Crawl Spaces	B.7
	306 Buildings with Combination Floor Systems	B.7
	307 Space Conditioning Systems	B.7

CHAPTER B101
GENERAL

B101 General. Provisions in the following chapters and sections shall constitute and be known as and may be cited as the *Florida Standard For Passive Radon-Resistant New Residential Building Construction*, hereinafter referred to as "this standard."

B102 Intent.

B102.1 General. This standard shall apply to the design and construction of new residential buildings as determined in Section B103, Scope, to enable control of human exposure to indoor radon and its progeny.

B102.2 Compliance. This passive standard will provide radon protection beyond that provided by standard building code provisions. Compliance with existing local building codes and with the *Florida Energy Efficiency Code for Building Construction*, current edition, is assumed.

B103 Scope.

B103.1 Applicability. The provisions of this standard shall apply to the construction of new residential buildings and additions to existing residential buildings. Residential buildings are defined for the purposes of this standard as one- or two-family detached houses and town house apartments with no more than three stories (distinguished from condominiums, apartments and commercial buildings that employ different construction practices).

B103.2 Additions. When the cost of an addition exceeds a cumulative total of 50 percent of the assessed value of the existing building, only the addition to the building must meet the requirements for new buildings in Section B104.1.

B104 Compliance.

B104.1 New buildings and additions. All new residential buildings and additions to existing residential buildings shall use passive radon protection measures, as determined in Chapter B3 of this standard.

B104.2 Exemptions. Exempt buildings are as follows:

1. Buildings of classifications not listed in Section B103.1, Applicability, and
2. Residential buildings built on piers or pilings that elevate the bottom of the floor joists a minimum of 18 inches (457 mm) above grade, which do not have skirting or stem walls that restrict air ventilation, and which comply with the following additional provisions:
   a. The perimeter of the building from the ground plane to the lower surface of the floor shall be totally open for ventilation, except for the occurrence of enclosures complying with item (c) below.
   b. All pilings, posts or other supports shall be solid, or if hollow, shall be capped by an 8 inch (203 mm) solid masonry unit or sealed by a permanent barrier that is impermeable to air flow.
   c. Enclosures of any kind, including chases, storage rooms, elevator shafts and stairwells, etc., that connect between the soil and the structure shall be sealed at the surface of the soil to comply with the sealing provisions of Chapter B3 and shall have a soil contact area of less than 5 percent of the total building floor area.

CHAPTER B201
DEFINITIONS

B201 General. For the purposes of this standard, certain abbreviations, terms, phrases, words and their derivatives shall be set forth in this chapter. Words not defined herein shall have the meanings stated in the *Florida Building Code, Building; Florida Building Code, Mechanical; Florida Building Code, Plumbing; Florida Building Code, Gas;* or *Florida Fire Prevention Code*. Words not defined in these codes shall have the meanings in *Webster's Ninth New Collegiate Dictionary*, as revised.

B202 Definitions.

ADDITION. A building extension or increase in floor area that can be occupied or that exchanges air with the conditioned space of the building.

AIR DISTRIBUTION SYSTEM. For the purposes of this standard, the air distribution system components which include ducts, plenums, air handlers, furnaces, single-package air conditioners, etc.

CAULKS AND SEALANTS. Those materials which will significantly reduce the flow of gases through small openings in the building shell. Among those used are:

Urethane. A crystalline ester-amide used as a gelatinizing agent for cellulose acetate or cellulose nitrate. A component of polyurethane used in making flexible and rigid foams, elastomers, and resins for coatings and adhesives.

Epoxy. A thermosetting resin characterized by adhesiveness, flexibility and resistance to chemicals and used chiefly as a coating or adhesive.

Polysulfide rubber. A synthetic rubber characterized by impermeability to gases and used in adhesives, binders and sealing compositions and in coatings.

CONDITIONED FLOOR AREA. The horizontal projection (outside measurements) of that portion of space which is conditioned directly or indirectly by an energy-using system.

CONDITIONED SPACE. All spaces which are provided with heated and/or cooled air or which are maintained at temperatures over 50°F (10°C) during the heating season, including adjacent connected spaces separated by an uninsulated component (e.g., basements, utility rooms, garages, corridors).

CONTRACTION JOINT. A formed, sawed, or tooled groove in a concrete slab to create a weakened plane and control the location of cracking resulting from drying and thermal shrinkage (also sometimes called control joint).

CRAWL SPACE. The unconditioned space between the lowest structural member of the floor and the earth. The crawl space is created when the floor spans between structural sup-

ports rather than being directly supported by the earth beneath the floor.

ELASTOMERIC. That property of macromolecular material of returning rapidly to approximately the initial dimensions and shape, after substantial deformation by a weak stress and release of stress.

HIGH RANGE WATER REDUCER. A chemical admixture added to the concrete capable of reducing the water content at least 12 percent. This admixture shall conform to ASTM C 494 Type F or G.

HVAC. Heating, ventilating and air conditioning.

INFILTRATION BARRIER. A product or system designed to limit the free passage of air through a building envelope component (wall, ceiling or floor). Such products and systems may be continuous or noncontinuous discrete elements which are sealed together to form a continuous barrier against air infiltration.

MANUFACTURED SANDS. Sands resulting from the crushing of rock, gravel or slag.

MASTIC. A sealant with putty-like properties.

MIDRANGE WATER REDUCER. A water reducing admixture capable of reducing water content from 6 to15 percent. This admixture shall conform to ASTM C 494 Type A and or F.

MITIGATE. Make less severe, reduce, relieve.

NATURAL SANDS. Sands resulting from the natural disintegration and abrasion of rock.

OCCUPANCY. The purpose for which a building or part thereof is used or intended to be used. For the purposes of determining changes of occupancy for this code, the occupancy shall be considered the major occupancy group designations established by the locally adopted building code.

OUTSIDE AIR. Air taken from the outdoors and, therefore, not previously circulated through the system.

PASSIVE RADON PROTECTION SYSTEM. Indoor radon reducing building design, material, or construction features that increase the barriers to radon entry and require no mechanical operation, operating costs, or user attention beyond normal home maintenance (such as recaulking floor cracks, etc.)

PERM. Unit of measurement of the water vapor permeance of materials. Value of one perm is equal to one grain of water vapor per square foot hour per inch of mercury vapor pressure difference.

PICOCURIE (pCi). A unit of measurement of radioactivity. A curie is the amount of any radionuclide that undergoes exactly 3.7 x 1010 radioactive disintegrations per second. A picocurie is one trillionth (10^{-12}) of a curie, or 0.037 disintegrations per second.

PICOCURIE PER LITER (pCi/L). A common unit of measurement of the concentration of radioactivity in a gas. A picocurie per liter corresponds to 0.037 radioactive disintegrations per second in every liter of air.

RADIUM (Ra). A naturally occurring radioactive element resulting from the decay of uranium. For the purposes of this standard, radium applies to Radium-226. It is the parent of radon gas.

RADON. A naturally occurring, chemically inert, radioactive gas. It is part of the Uranium-238 decay series. For the purposes of this standard, radon applies to Radon-222; thus, it is the direct decay product of Radium-226.

REMOTE SPACE. A space isolated from the main conditioned area of a building by intermediate non-conditioned spaces.

RESIDENTIAL BUILDING. A residential occupancies which include single-family and multiple-family buildings that are three or fewer stories above grade. Hotels, motels and other transient occupancies are considered nonresidential buildings for the purpose of this standard.

SLUMP. A measure of the relative consistency or stiffness of fresh concrete mix, as defined by ASTM C 143.

SOIL GAS. Gas which is always present underground, in the small spaces between particles of the soil or in crevices of rock. Major constituents of soil gas include air and water vapor. Since Radium-226 is essentially always present in the soil or rock, trace levels of Radon-222 also will exist in the soil gas.

SUBSTRUCTURE MEMBRANE. Flexible, nondegrading material sheet placed between the soil and the building for the purpose of reducing the flow of soil gas and moisture into the building. Examples are: polyethylene, ethylenepropylene diene terpolymer (EPDM), neoprene, and cross laminated HDPE.

VENTILATION. The process of supplying or removing air, by natural or mechanical means, to or from any space. Such air may or may not have been conditioned.

WATER-REDUCING ADMIXTURE. A chemical additive to concrete capable of increasing its flowability without increased mixing water, without set retardation, and without increased air entrainment.

CHAPTER B301
CONSTRUCTION REQUIREMENTS FOR PASSIVE RADON CONTROL

B301 General. This chapter provides minimum design and construction criteria for passive control of radon entry into residential buildings. Construction to these standards will limit radon entry points through building floors and foundations and will limit mechanical depressurization of buildings which can enhance radon entry.

B302 Sub-slab and soil membranes.

B302.1 Membrane material. A sub-slab or soil-cover membrane shall consist of a minimum 0.006 inch (0.152 mm) (6 mil) thick single layer of polyethylene. Polyvinylchloride (PVC), ethylene propylene diene terpolymer (EPDM), neoprene or other nondeteriorating nonporous material may be used instead of polyethylene, provided the installed thickness has greater or equal resistance to air flow, puncturing, cutting and tearing, and a permeance of less than 0.3 perm as determined in accordance with ASTM E 96. The membrane shall be placed to

minimize seams and to cover all of the soil below the building floor.

B302.2 Tape. Tape used to install the membrane shall have a minimum width of 2 inches (51 mm) and shall be pressure sensitive vinyl or other nondeteriorating pressure sensitive tape compatible with the surfaces being joined. Paper tape and/or cloth shall not be used for these purposes.

B302.3 Mastic. Mastic used to install the membrane shall be compatible with the surfaces being joined, and shall be installed in accordance with the manufacturer's recommendations for the materials, surface conditions and temperatures involved. Mastic may be used to join sections of membrane to one another or to elements of the building foundation, or to seal penetrations in the membrane.

B302.4 Installation. The membrane shall be placed under the entire soil-contact area of the floor in a manner that minimizes the required number of joints and seams. Care shall be taken to prevent damage to the membrane during the construction process.

B302.5 Seams. Seams between portions of the membrane shall be lapped a minimum of 12 inches (305 mm) and shall be secured in place with a continuous band of tape or mastic centered over the edge of the top membrane.

B302.6 Slab edges and joints. The membrane shall fully cover the soil beneath the building floor. Where the slab edge is cast against a foundation wall or grade beam, the membrane shall contact the foundation element, and shall not extend vertically into the slab more than one inch.

B302.7 Penetrations, punctures, cuts and tears. At all points where pipes, conduits, stakes, reinforcing bars or other objects pass through the membrane, the membrane shall be fitted to within $^1/_2$ inch (12.7 mm) of the penetration and sealed to the penetration. Penetrations may be sealed with either mastic or tape. When necessary to meet this requirement, a second layer of the membrane, cut so as to provide a minimum 12 inches (305 mm) lap on all sides, shall be placed over the object and shall be sealed to the membrane with a continuous band of tape.

B302.8 Repairs. Where portions of an existing slab have been removed and are about to be replaced, a membrane shall be carefully fined to the opening and all openings between the membrane and the soil closed with tape or mastic.

B303 Floor slab-on-grade buildings.

B303.1 General. All concrete slabs supported on soil and used as floors for conditioned space or enclosed spaces connected or adjacent to a conditioned space shall be constructed in accordance with the provisions of Sections B302 and B303.

B303.2 Slab edge detail. Slabs and foundations shall be constructed using a slab edge detail that eliminates cracks that could connect the house interior to subslab soil and is consistent with other construction constraints such as terrain. Monolithic slab construction should be used where possible. Only the following slab edge detail options may be used:

1. Thickened edge monolithic–The subslab membrane shall extend beyond the outside face of the slab edge.
2. Slab poured into stem wall–Where concrete blocks are used as slab forms, the subslab membrane shall extend horizontally at least 1 inch (25.4 mm) into the stem wall, but shall not extend upward along any vertical faces of the stem wall. The concrete slab shall be poured into the stem wall to completely fill its open volume to form a continuous and solid stem wall cap of minimum 8 inch (203 mm) thickness. Framed exterior walls shall be sealed or gasket to the slab.
3. Slab capping stem wall–Where the floor slab is formed and placed to completely cover the stem wall, the subslab membrane shall extend horizontally beneath the slab to its outer edge. The supporting stem wall shall be capped with a solid masonry unit of at least 4 inch (102 mm) thickness beneath the membrane and the slab.

B303.3 Sealing of joints, penetrations and cracks in slabs.

B303.3.1 Contraction joints. All contraction joints shall be cleaned and sealed against soil-gas entry by use of an approved sealant (see Section B303.6) applied according to the manufacturer's instructions. (Note: most sealants require the concrete to be cured and dried.) For bottom-induced joints, inverted T-split ribbed waterstops at least 6 inches (152 mm) wide made of impermeable material may be formed into the slab and shall not require top-surface sealing for radon control.

B303.3.2 Horizontal joints. Horizontal joints between two slabs of different elevations that are poured at different times shall provide horizontal contact between the two slabs that is at least 8 inches (203 mm) wide, or shall be sealed by an approved sealant (Section B303.6).

B303.3.3 Vertical joints through slabs. Vertical joints through slabs shall be formed with a recess of not less than $^1/_4$ inch by $^1/_4$ inch (6.4 mm by 6.4 mm) and sealed with an approved sealant.

Exception: Slabedge vertical joints occurring in slab poured into stem wall construction [see Section B303.2(2)]. The sealant (see Section B303.6) shall be applied according to the manufacturer's instructions. (Note: most sealants require the concrete to be cured and dried.)

B303.3.4 Penetrations.

B303.3.4.1 Stake penetrations. Any stake that extends through more than one-fourth the thickness of the slab shall be of a nonporous material resistant to decay, corrosion and rust, and shall be cast tightly against the slab, or sealed to the slab in accordance with Section B303.6. All stakes shall either be solid, or shall have the upper end tightly sealed by installation of an end cap designed to provide a gas-tight seal.

B303.3.4.2 Work spaces. Work spaces formed into a slab, such as beneath a shower or bath tub drain, shall be sealed gas tight. The exposed soil shall be compacted and then shall be fully covered with a sol-

vent-based plastic roof cement or a foamed-in-place polyurethane sealant or other approved elastomeric material to a minimum depth of 1 inch (25.4 mm).

B303.3.4.3 Pipe penetrations. Plastic pipes shall be in contact with the slab along the slab's depth by casting the concrete tightly against the pipe. Where pipes are jacketed by sleeves they shall be sealed by one of the following methods:

1. Formation of a slot in the slab around the pipe and casting with asphalt or an approved sealant from the slab to a point above the sleeve, or
2. Seal the space between the sleeve and the pipe with an appropriate joint sealant (see Section B303.6).
3. Pipes and wiring penetrating the slab through chases or conduit shall be sealed by placing an approved sealant between the pipe or wiring and chase or conduit. Plastic sheath, foam or insulation material shall not be used alone around pipes or conduit for sealing purposes.
4. Where multiple pipes are ganged, block out a work space around the multiple pipes and seal as in Section B303.3.4.2.

B303.3.5 Cracks. All slab cracks greater than $^1/_{32}$ inch (0.8 mm) wide; all cracks that exhibit vertical displacement; all cracks that connect weakened zones in the slab such as vertical penetrations or re-entrant corners; and, all cracks that cross changes in materials or planes in the structure, shall be cleaned and sealed against radon entry, prior to applying floor covering, with a flexible field-molded elastomeric sealant installed in accordance with Section B303.6. Cracks less than $^1/_{32}$ inch (0.8 mm) in width that do not meet any of the above criteria may be left unsealed.

B303.4 Concrete for slabs.

B303.4.1 Mix design. Mix designs for all concrete used in the construction of slab-on-grade floors shall specify a minimum design strength of 3,000 psi (20.7 MPa) at 28 days and a design slump not to exceed 4 inches (102 mm). On-site slumps shall not exceed 5 inches (127 mm), provided total water added to the mix including plant, transit and site added water does not exceed the following parameters:

1. For mixes using natural sands–275 pounds per cubic yard [33 gallons (125 L)].
2. For mixes using manufactured sands–292 pounds per cubic yard [35 gallons (132.5 L)].

B303.4.2 Concrete placement. For improved workability of concrete used in the construction of slab-on-grade floors, additional water and/or water-reducing admixtures shall be wed within the following constraints:

1. Slumps in excess of 5 inches (127 mm) shall be achieved through the use of midrange or high-range water reducing admixtures. Water shall not be used in excess of the limitations.
2. Slumps of concrete containing midrange or high range water reducing admixtures shall not exceed 8 inches (203 mm).

B303.4.3 Curing. Concrete slabs shall be cured continuously after pouring according to one of the following procedures:

1. Moist curing by means of ponding, fog spray or wet burlap for at least seven days.
2. Moist curing using impermeable cover sheet materials conforming with ASTM C 171 for at least seven days.
3. Curing with liquid membrane forming compound according to manufacturer's specifications and conforming with ASTM C 309.

Curing compounds shall be compatible with materials specified in Section B303.6.

B303.4.4 Loading. Loading or use of the slab shall be delayed for a minimum of 48 hours after concrete placement. When the slab is used for material storage after the minimum 48-hour period, caution should be used to prevent impact loading.

B303.4.5 Slab reinforcement. Floor slabs shall be reinforced by steel reinforcing bars at reentrant corners such as inside corners of an L-shaped slab. Reentrant corners shall have two pieces of #4 reinforcing bar 36 inches (914 mm) long placed diagonally to the corner, 12 inches (305 mm) apart, with the first bar placed 2 inches (51 mm) from the corner. All reinforcement shall be appropriately positioned in the upper third of the slab.

B303.5 Sealing walls. Penetrations for electrical receptacles and switches, wiring, plumbing, etc. in the interior surface of the concrete block walls shall be sealed.

B303.6 Approved sealant material. Acceptable polyurethane, polysulfide and epoxy caulks and sealants shall conform with ASTM C 920-87, *Standard Specifications for Elastomeric Joint Sealants*, and ASTM C 1193-91, *Standard Guide for Use of Joint Sealants*. Sealant material and the method of application shall be compatible with curing compounds, admixtures and floor finishing materials; withstand light traffic; be impermeable to soil gas; and have an allowable extension and compression of at least 25 percent with 100 percent recovery. Sealants shall be applied to dried and cured concrete in accordance with manufacturers' instructions. Backer rods may be used to support sealants in cracks and joints.

B304 Slab-below-grade construction.

B304.1 General. For the purposes of this standard, slab-below-grade construction is defined as any conditioned space with the finished floor below finished grade at any point.

B304.2 Slab construction. Slabs shall have a sub-slab membrane, conforming with Section B302 that extends to the slab perimeter, but does not vertically separate the slab from the foundation wall. The slab and membrane shall be placed in accordance with Section B303, or may use a floating slab design with all of the following conditions:

1. The stem wall is solid poured concrete.

2. The slab-wall joint is tooled and sealed with flowable polyurethane (according to Section B303.6).
3. All other provisions of Section B303 are satisfied.

B304.3 Sealing walls.

B304.3.1 Walls. Walls surrounding slab-below-grade space shall be constructed from solid poured concrete, at least 8 inches (203 mm) thick, and shall be sealed with a continuous waterproofing coating applied to their outside surface from the top of the footing to finished grade. This coating shall completely seal any joint between the footing and the wall.

B304.3.2 Utility penetrations. All utility penetrations through walls in partial or full contact with the soil shall be closed and sealed with an approved sealant material (see Section B303.6) on the interior and exterior faces of the wall.

B304.4 Sumps. Any sump located in a habitable portion of a building, or in an enclosed space directly attached to a portion of a building, shall be covered by a lid. An air tight seal shall be formed between the sump and lid and at any wire or pipe penetrations.

B305 Buildings with crawl spaces.

B305.1 General. For the purposes of this standard, buildings with crawl spaces include all buildings with floor supported above grade which do not meet the requirements of Section B306.

B305.2 Floor systems. Reinforced concrete floors constructed over crawl spaces shall conform to all applicable provisions of Section B303. Wood-framed floors constructed over crawl spaces shall include an air infiltration barrier in compliance with Chapter 13 of the *Florida Building Code, Building*, current edition. All joints and penetrations through the floor, including plumbing pipes, conduits, chases, wiring, ductwork and floor-wall joints, shall be fully sealed with an approved caulk. Where large openings are created (such as at bathtub drains), sheet metal or other rigid materials shall be used in conjunction with sealants to close and seal the openings.

B305.3 Crawl space ventilation. Screened vents without closures shall be installed around the perimeter of the house to connect the crawl space with outdoor air.

B305.3.1 Vent area. The crawl space vents shall have a total area equal to either:

1. At least $^1/_{150}$ of the area enclosed by the crawl space if the crawl space is exposed to bare soil; or
2. At least $^1/_{300}$ of the area enclosed by the crawl space if the crawl space is completely covered by a substructure membrane.

B305.3.2 Ventilation obstructions. The crawl space shall not contain structures that restrict ventilation in the crawl space. If freeze protection is provided for plumbing in the crawl space, the protection shall not restrict air ventilation in the crawl space.

B305.4 Sealing walls and doors. Penetrations from the crawl space into wall cavities shall be fully sealed with an approved caulk or sealant. When a door is located between the crawl space and the conditioned space, it shall be fully weatherstripped or gasketed.

B305.5 Closing and sealing other paths. Any openings that connect a crawl space and the closed space between floor or ceiling joists, wall studs, or any other cavity adjoining conditioned space shall be closed and sealed.

B305.6 Soil connection. Foundation walls and piers or other intermediate supports that intersect the floor plane shall be solid across the entire horizontal section at a point above the ground plane.

B306 Buildings with combination floor systems.

B306.1 Floor system construction. Where slab-on-grade, slab below-grade, crawl space or elevated building construction are combined in one structure, the provisions for each construction type shall be met.

B306.2 Walls. A wall located between a crawl space and conditioned space shall be designed and constructed in compliance with Chapter 13 of the *Florida Building Code, Building*, current, and the provisions of the applicable Sections B303 through B305 of this standard.

B307 Space conditioning systems.

B307.1 Equipment enclosures.

B307.1.1 Crawl spaces. Return ducts, return plenums and air handlers shall not be located in crawl spaces. Crawl spaces shall not be used as supply or return plenums.

B307.1.2 Condensate drains, piping and wiring chases. Condensate drain pipe joints shall be sealed (chemical weld, soldered, etc.) gas tight and shall terminate outside the building perimeter at a height of at least 6 inches (152 mm) above the finished grade ground level. Chases through which the condensate and refrigerant lines run shall not terminate in the return sections of the air distribution system. Where chase lines terminate within the house or garage, they shall be sealed.

B307.2 Air distribution systems.

B307.2.1 Sealing. All ducts and plenums shall be made air tight, constructed and installed in accordance with the current edition of Chapter 13 of the *Florida Building Code, Building* for building construction. Where rigid fibrous glass ductboard is used, the seal must be on the foil air barrier side of the ductboard.

B307.2.2 Return plenums and ducts. Return air shall be separated from any floor that is in contact with the soil or a crawl space, by a plenum or duct fabricated in compliance with Section B307.2.1 and all local codes. Construction of the return plenum or duct shall provide a continuous air barrier that completely separates the depressurized plenum or duct from adjacent building components including but not limited to floors, walls, chases, enclosures, etc. The support platform shall not be used as a return plenum. Where the support platform pro-

vides a protective enclosure for a duct, one side shall have a removable panel or door to provide access for inspection and/or repair of the duct and duct-to-air handler connection. Ducts shall carry the return air from the return grills or return plenums to the air handler and shall have a positive air-tight seal to the air handler. A closet shall not be used as a return plenum.

B307.2.3 Return grille connection. The return pathway from the return grille shall be a part of the return duct or plenum and shall have a continuous air barrier along its boundary. Where the return pathway passes through a wall cavity, the cavity shall be sealed around the duct in all directions to prevent the leakage of air into the return air stream.

B307.2.4 Location of ducts and plenums. Supply and return ducts shall not be located below concrete slab-on-grade floors, and return ducts and plenums shall not be located in crawl spaces.

B307.3 Exhaust fans.

B307.3.1 Bathroom fans. Bathroom exhaust fans shall be controlled by an independent separate switch. Manually operated timers should be used as applicable.

B307.3.2 Attic fans. If used, attic exhaust fans shall be installed with unobstructed vent and intake areas in accordance with the minimum areas prescribed by their manufacturer. In no case shall effective open vent area be less than the minimum areas prescribed by the manufacturer.

APPENDIX C

CHAPTER 9B-53 F.A.C
STANDARD FOR MITIGATION OF RADON IN EXISTING BUILDINGS

9B-53.001 Purpose and intent. (Repealed)

9B-53.002 Definitions.

9B-53.003 Department activities.

9B-53.004 Florida Standard for Mitigation of Radon in Existing Buildings, Adopted.

9B-53.001 Purpose and Intent.
Specific Authority 553.98(1) FS.
Law Implemented 553.98 FS.
History–New 2-26-91, Repealed 2-20-96.

9B-53.002 Definitions.

For the purpose of this rule chapter, the following words, unless the context does not permit such meaning, shall have the meanings indicated:

1. Department–The Department of Community Affairs.
2. Exempted Buildings–Structures not intended for human occupancy.
3. Existing Building–Any structure erected prior to the adoption by the local government of the building code presently enforced in that jurisdiction, and which has been issued a certificate of occupancy or has been legally occupied.
4. Radon–A naturally occurring, chemically inert, radioactive gas. It is part of the Uranium-238 decay series, and is the direct decay product of Radium-226.
5. Standard–The *Florida Standard for Mitigation of Radon in Existing Buildings*.

Specific 553.98(1) FS.
Law Implemented 553.98 FS.
History–New 2-26-91.

9B-53.003 Department activities.

1. The department may interpret and clarify various aspects of the *Florida Standard for Mitigation of Radon in Existing Buildings*. The department will promulgate such rules and regulations as will from time to time be deemed necessary to carry out its purpose.
2. The department shall provide training on the use of the standard.
3. Within two years of the date of adoption of the standard, and at least biennially thereafter, the department shall update and adopt standards based on the most current research. Any person may submit recommendations for proposed revisions or modifications to the standard to the department for consideration. Such proposed revisions and modifications shall be submitted in writing on Department of Community Affairs Form #200, the "Proposed Code Change Request" form, incorporated herein by reference, effective 1991. Such proposals shall include an identification of the section of the standard to be revised, the new proposed language, and a justification or reason for the change. The department shall conduct a public hearing(s) in accordance with the requirements of Chapter 120, F.S. Proposed revisions or modifications deemed necessary and appropriate by the department shall then be adopted for implementation pursuant to Chapter 120, F.S., and Section 553.98, F.S.
4. The department may contract for supplemental consulting services necessary for performance of its duties.
5. Any person may request information or interpretations regarding the application and administration of the standards adopted herein, provided any oral request is later confirmed by the party to the department in writing.
6. The department shall collect such data as necessary to evaluate the effectiveness and extent of implementation of this standard.

Specific 553.98(1), 120.53(1)(a) FS.
Law Implemented 553.98 FS.
History–New 2-26-91.

9B-53.004 Florida Standard for Mitigation of Radon in Existing Buildings.

1. The June 1994 edition of the *Florida Standard for Mitigation of Radon in Existing Buildings*, that edition of the standard having an effective date of June 1, 1994, is herein incorporated by reference. The department shall revise, update and maintain the Florida *Standard for Mitigation of Radon in Existing Buildings*.
2. A copy of the above referenced standard as amended has been filed with these regulations with the Secretary of State. The standard is also available for reference and inspection at the department offices in Tallahassee, Division of Housing and Community Development.

Specific 553.98(1) FS.
Law Implemented 553.98 FS.
History–New 2-26-91, Amended 5-10-94.

FLORIDA STANDARD FOR MITIGATION OF RADON IN EXISTING BUILDINGS

Effective: June 1, 1994

Introduction

Radon is a radioactive gas which occurs naturally in soils. It has been found in high concentrations in some areas of many states including Florida. Radon can enter buildings through floor cracks and openings driven by pressure differences which result from space conditioning and ventilation systems, temperatures and wind. Its radioactive decay products can cause lung cancer when inhaled.

The following building standards have been developed in accordance with Section 553.98, Florida Statues to protect the public by setting standards for mitigation of radon concentrations in existing buildings.

Principal Approaches for Radon Mitigation in Existing Buildings.

This building standard addresses five principal approaches to mitigating radon accumulation in buildings:

1. Radon control using the building structure as a gas barrier. This is a passive approach which requires no fans (see Chapter 4).
2. Radon control by lowering the air pressure in the soil beneath the building relative to the indoor air pressure of the building. This is an active approach which requires one or more electrically driven fans (see Chapter 6).
3. Radon control by raising the indoor air pressure in the building relative to the air pressure in the soil beneath the building. This is an active approach which may either use an existing heating and air-conditioning system blower or an additional electrically driven fan. This approach may have significant negative impact on the annual energy consumption of the building due to heating and cooling of additional outdoor air in addition to fan power consumption (see Chapter 5).
4. Radon control by ventilating the building with outdoor air. This is an active approach which may either use an existing heating and air-conditioning system blower or an additional electrically driven fan. This approach may have significant negative impact on the annual energy consumption of the building due to heating and cooling of additional outdoor air and to increased fan power consumption (see Chapter 5).
5. Radon control by separating the building and source with a ventilated region of outside air. This approach is generally applicable to buildings with a crawl space, and may be either active or passive (see Chapter 6).

The standard does not mandate the implementation of any of the principal approaches listed above. It establishes minimum standard practices for each of the principal approaches. Implementation of these minimum standard practices does not guarantee successful mitigation. A post mitigation indoor radon concentration test must be conducted to demonstrate successful mitigation in compliance with the rules of the Department of Health and Chapter 3 of this standard.

FOREWORD

The practices incorporated in the standard are based on experience, testing, and in certain cases expectations founded on interpretation of fundamental physical principles. The demonstration at successful mitigation utilizing the different approaches incorporated in this standard varies.

Subslab depressurization, crawlspace ventilation, and submembrane depressurization have the highest demonstrated success rates. Success with these approaches has in many cases required modification and enhancement of systems based on post mitigation indoor radon tests.

Effective sealing of accessible entry points has been demonstrated to make a significant impact on indoor radon concentrations. However, mitigation by sealing entry points alone has not had a demonstrated level of success equivalent to the aforementioned active mitigation systems. This is understood to be principally because of the difficulty in locating and treating enough entry points to resist the driving forces which cause radon laden soil gas and crawlspace air entry. The significance of entry points and their treatment can be ranked based on their size, location and the degree of depressurization of the building space surrounding them. Design and construction of successful subslab depressurization systems also depends on entry point size, location and the magnitude of coincident building depressurization. Attention to limiting entry at points of high depressurization such as space conditioning system return plenums, mechanical closets, etc., is critical to the success of both passive mitigation and minimally designed active mitigation systems.

Building pressurization is expected, based on fundamental principles, to provide a potentially effective mitigation strategy. The effectiveness for individual cases may rely on occupant behavior as well as building leakage characteristics. Pressurization systems also have potentially major impacts on occupant comfort, humidity control and energy use.

Building ventilation has potential application where low indoor radon concentrations exist initially. This approach can have significant impacts on the ability of a building's climate control systems to perform adequately in the hot and humid climate and on energy consumption for comfort conditioning.

None of the techniques in this standard are guaranteed to provide adequate mitigation. The complexities of existing buildings and the inherent limitations in the ability to determine the building's construction characteristics result in conditions too diverse for a standard to anticipate. Successful mitigation depends on the experience of the mitigator to make an effective selection of mitigation options. A post mitigation indoor radon test is essential for determining if initial mitigation has been successful. Proper maintenance and operation of mechanical systems implemented as part of active mitigation approaches are critical to the long term effectiveness of mitigation where such systems are used. Periodic retests of indoor radon concentrations at least every two years, and when the building undergoes significant structural alterations, are advised for all mitigation approaches to provide continued assurance of safe indoor radon levels.

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CHAPTER C101
ADMINISTRATION

C101 General.

C101.1 Title. Provisions in the following chapters and sections shall constitute and be known as, and may be cited as, the Florida *Standard For Mitigation of Radon in Existing Buildings,* hereinafter referred to as "this standard."

C101.2 Intent.

C101.2.1 General. This standard applies to those alterations to existing buildings that are implemented to reduce indoor radon concentrations, in order to enable control of human exposure to indoor radon and its progeny.

C101.2.2 Limits. This standard is intended to improve indoor air quality with respect to radon. These standards are based on the principle of limiting radon concentrations to levels as low as reasonably achievable, within the limitations at current technology and economic feasibility. Use of this standard does not guarantee radon will be limited to any specific concentrations in a building; however, experience indicates a reduction in radon and its progeny can be realized by using the mitigation strategies described in this standard.

C101.2.3 Durability. Experience with the radon-resistant construction details contained herein has been limited to a fraction of the average life of a building. Implementation of radon mitigation measures described herein does not guarantee that mitigation effects will be permanent. Periodic inspection and maintenance of the radon mitigation measures and retesting of indoor radon levels is the responsibility of the building owner.

C101.3 Scope.

C101.3.1 Applicability. The provisions of this standard shall apply to the construction or alteration associated with the mitigation of indoor radon in every building or structure not specifically exempted. Exempted occupancies shall include structures not intended for human occupancy.

C102 Alternate materials and methods. The provisions of this standard are not intended to prevent the use of any material or method of construction not specifically prescribed by this standard, provided any such alternate is demonstrated according to the provisions of Chapter C3 of this standard, to be effective at the control of radon.

C103 Compliance. All mitigation shall be deemed to be in compliance with this standard when: (a) the techniques utilized in mitigation meet the minimum standard practices established herein; and (b) the building is determined to meet the "not to exceed" exposure standard established by the DOH or the level specified in any warranty or guarantee provided to the client. The DOH has set an exposure standard for radon decay products in buildings at an annual average of 0.02 working levels. Under conditions often encountered in homes, this is equivalent to an annual average radon level of 4.0 picoCuries per liter. Radon levels in most buildings can be reduced to 4.0 picoCuries per liter or below.

Testing must be conducted in accordance with all applicable sections of the DOH *Florida Administrative Code,* Chapter 64E-5 and in accordance with Chapter C3 of this standard.

CHAPTER C201
DEFINITIONS

C201 General. For the purposes of this standard, certain abbreviations, terms, phrases, words and their derivatives shall be set forth in this chapter. Where terms are not defined therein, they shall have the meaning as noted in the applicable locally adopted code. Words not defined in any locally adopted code shall have the meanings in *Webster's Ninth New Collegiate Dictionary*, as revised.

C202 Definitions.

AUTOMATIC. Self-acting, operating by its own mechanism when activated by some personal influence, as for example, a change in current, pressure, temperature or mechanical configuration.

CAULKS AND SEALANTS. Those materials which will significantly reduce the flow of gases through small openings in the building shell. Among those used are:

Urethane. A crystalline ester-amide used as a gelatinizing agent for cellulose acetate or cellulose nitrate. A component of polyurethane used in making flexible and rigid foams, elastomers, and resins for coatings and adhesives.

CONDITIONED SPACE. All spaces which are provided with heated and/or cooled air or which are maintained at temperatures over 50°F (10°C) during the heating season, including adjacent connected spaces separated by an uninsulated component (e.g. basements, utility rooms, garages, corridors).

CONTRACTOR. A building trades professional licensed by the state, including certified mitigation business.

CRAWL SPACE. An area beneath the living space in some houses, where the floor of the lowest living area is elevated above grade level. This space (which generally provides only enough head room for a person to crawl in), is not living space, but often contains utilities.

DEPRESSURIZATION. A condition that exists when the measured air pressure is lower than the reference air pressure.

ELASTOMERIC. That property of macromolecular material of returning rapidly to approximately the initial dimensions and shape, after substantial deformation by a weak stress and release of stress.

Mil - 1 mil = 1/1000 of an inch

MITIGATION. The act of making less severe, reducing or relieving. For the purposes of this standard, a building shall not be considered as mitigated until it has been demonstrated to meet the standards of compliance specified in Section 103.

OUTSIDE AIR. Air taken from the outdoors and, therefore, not previously circulated through the system.

PICOCURIE (pCi). A unit of measurement of radioactivity. A curie is the amount of any radionuclide that undergoes exactly 3.7 x 1010 radioactive disintegrations per second. A picocurie is one trillionth (10-12) of a curie, or 0.037 disintegrations per second.

PICOCURIES PER LITER (pCi/l). A common unit of measurement of the concentration of radioactivity in a gas. A picocurie per liter corresponds to 0.037 radioactive disintegrations per second in every liter of air.

RADIUM (Ra). A naturally occurring radioactive element resulting from the decay of Uranium. It is the parent of radon.

RADON (Rn). A naturally occurring, chemically inert, radioactive gas. It is part of the Uranium-238 decay series, it is the direct decay product of Radium-226.

SOIL DEPRESSURIZATION SYSTEM. A system designed to withdraw air below the slab through means of a vent pipe and fan arrangement (active).

SOIL GAS. Gas which is always present underground, in the small spaces between particles of the soil or in crevices in rock. Major constituents of soil gas include nitrogen, water vapor, carbon dioxide, and (near the surface) oxygen. Since Radium-226 is essentially always present in the soil or rock, varying levels of Radon-222 will exist in the soil gas.

SOIL GAS RETARDER. A concrete slab; polyvinylchloride (PVC) ethylenepropylene dieneterpolymer (EPDM), neoprene or other flexible sheet material; or other system of materials placed between the soil and the building for the purpose of reducing the flow of soil gas into the building.

VENTILATION. The process of supplying or removing air, by natural or mechanical means, to or from any space. Such air may or may not have been conditioned.

CHAPTER C301
TESTING

C301 General. Where mitigation projects are performed by commercial mitigation contractors, all tests performed to demonstrate compliance with this standard must be performed by a certified radon measurement business certified by the Florida Department of Health and Rehabilitative Services. Compliance tests must be performed by a measurement business independent of the mitigation contractor.

C301.1 Test procedures. Testing shall be conducted according to the procedures in the appropriate sections of EPA 402-R-92-004, *Indoor Radon and Radon Decay Product Measurement Device Protocols* (US EPA, July, 1992) and EPA 402-R-92-003, *Protocols for Radon and Radon Decay Product Measurements in Homes* (USEPA, June 1993).

C301.2 Acceptable devices and test periods. Selection of devices, operational devices, and test periods shall be in accordance with EPA 402-R-92-004.

C301.2.1 Acceptance criteria. The building will be deemed to comply with the standard if post mitigation test results performed in accordance with this chapter and all applicable sections of Chapter 64E-5, *Florida Administrative Code*, Part XII, Subpart A, meet the "not to exceed" exposure standard established by the DOH or the level specified in any warranty or guarantee to the client.

CHAPTER C401
STRUCTURAL SEALING AND HVAC SYSTEM BALANCING

C401 General. When accessible cracks, penetrations, and joints in floors and walls in contact with the soil, or separating conditioned space from a crawl space, are sealed to reduce radon entry, they shall as a minimum be sealed in accordance with the provisions of this chapter. In addition, when acceptable indoor radon concentrations are attained by the sealing of ducts and plenums, they shall be done in accordance with the provisions of this chapter.

C402 Sealing cracks and joints in concrete floors and walls.

C402.1 Small cracks and joints. Cracks and joints with widths less than $^1/_{16}$ inch (1.6 mm) shall be repaired by the application of an elastomeric material capable of withstanding at least 25 percent extension and extending at least 4 inches (102 mm) beyond the length and width of the crack, or by the method described in Section C402.2.

C402.2 Large cracks and joints. Cracks with widths larger than $^1/_{16}$ inch (1.6 mm) shall be enlarged to a recess with minimum dimensions of $^1/_4$ inch by $^1/_4$ inch (6.3 mm by 6.3 mm) and sealed with an approved caulk or sealant applied over a sealant backer in accordance with the manufacturer's recommendations. Cracks and joints with widths less than $^1/_{16}$ inch (1.6 mm) may also be sealed in this manner if traffic, floor covering material or other conditions are inconsistent with the provisions of Section C402.1.

C402.3 Utility penetrations, work spaces and large slab openings. Where large openings through the slab exist, such as at a bath tub drain or a toilet flange, an acceptable method for sealing the exposed soil shall include fully covering the exposed soil with a solvent based plastic roof cement or other approved material as per Section C405.1 to a minimum depth of 1 inch (25 mm). Where voids between masonry foundation walls and the slab edge are accessible, and are sealed in order to reduce radon entry, nonshrinking cementitious material may be used.

C402.4 Utility penetrations in crawl space walls. Utility penetrations or other openings through hollow cavity walls that separate conditioned space from soil, or conditioned space from a crawl space, shall be sealed with an approved material on both the interior and exterior faces of the wall. Penetrations and openings through solid concrete floors or walls may be sealed on only the interior face.

C402.5 Hollow masonry walls. All openings for electrical boxes or plumbing or other wall penetrations in hollow masonry walls, that are sealed in order to reduce radon entry, shall be sealed with an approved caulk and/or gasket on the interior face of the wall.

C402.6 Sumps. Any sump located in a conditioned portion of a building, or in an enclosed space directly attached to a conditioned portion of a building, shall be covered by a lid. An air tight seal shall be formed between the sump and lid and at any wire or pipe penetrations.

C403 Floors over crawl space.

C403.1 Reinforced concrete floors. Cracks and penetrations through concrete floors constructed over crawl spaces,

and that are sealed in order to reduce radon entry, shall be sealed in conformance with all applicable provisions of Section C402.

C403.2 Wood-framed floors. All penetrations through the subfloor, including but not limited to plumbing pipes, wiring and ductwork, that are sealed in order to reduce radon entry, shall be sealed with an approved caulk in accordance with the manufacturer's recommendations. Where large openings are created by plumbing, such as at bath tub drains, sheet metal or other rigid and durable materials shall be used in conjunction with sealants to close and seal the opening.

C404 Combined construction types.

C404.1 Structural chases. Openings which connect a crawl space and the space between floor or ceiling joists, wall studs, or any other hollow chase adjoining conditioned space, that are sealed in order to reduce radon entry concentrations, shall be closed and sealed in accordance with the appropriate portions of this chapter.

C404.2 Wall penetrations. Openings for electrical or plumbing connections in a wall between a crawlspace and a conditioned space, that are sealed in order to reduce radon entry, shall be closed and sealed with an approved caulk and/or gasket.

C404.3 Doors. When a door is located in a wall between a crawlspace and the conditioned space, it shall be fully weatherstripped or gasketed.

C405 Approved sealant materials.

C405.1 Sealants. Acceptable caulks and sealants shall conform with ASTM C 920-87, *Standard Specifications for Elastomeric Joint Sealants* and ASTM C 962-86, *Standard Guide for Use of Elastomeric Joint Sealants*. All sealant materials and methods of application shall be compatible with the location, function and material of the surface or surfaces being sealed.

C406 Space conditioning and ventilation systems.

C406.1 Mechanical system connections. Condensate drains and pipe chases for freon lines that provide a direct connection between the indoor air and the soil shall be sealed in accordance with the provisions of this section.

C406.1.1 Condensate drains. Condensate drains shall connect to air outside the building perimeter at a height of at least 6 inches (152 mm) above the finished grade ground level. Chases through which the condensate and refrigerant lines run shall not terminate in the air return plenum or duct. If a portion of the condensate pipe does not drop below the height of the condensate outlet, then a trap should be installed to prevent suction of outdoor air into the air handler.

C406.1.2 Freon chases. Freon chases that terminate within the house or garage shall be sealed with closed cell expanding foam material. Pipe insulation shall be removed from the freon lines at the point of the seal to provide for complete bond between the freon line and the foam.

C406.2 Air distribution systems.

C406.2.1 Sealing. All ducts and plenums that are modified or sealed in order to achieve acceptable indoor radon concentrations, shall be made airtight in accordance with Chapter 13 of the *Florida Building Code, Building*, 2004. If ductboard is used, the seal must be on the foil side of the ductboard. Mastic sealing systems designed specifically for the conditions of use shall be used in accordance with the manufacturer's recommendations to close and seal leaks in ducts or plenums. Modifications to ducts located in crawlspaces or service areas of attics shall incorporate support, cover or other protection from accidental damage.

C406.2.2 Return plenums. If acceptable indoor radon concentrations are achieved in part by construction or modification of a return plenum, it shall be constructed with materials and closures which produce a continuous air barrier for the life of the building. Construction of the return plenum shall be done such that a continuous air barrier completely separates the plenum from adjacent building structures. If duct board is the primary air barrier, then the joints shall be sealed by fabric and mastic on the foil side of the board.

CHAPTER C501
ENGINEERED SYSTEMS

C501 General. Design of radon mitigation systems must be signed by a certified radon mitigation specialist. Additionally, for radon mitigation systems that rely upon ventilation or pressurization of the conditioned space for radon control, the plans and specifications for the ventilation or pressurization system shall be signed and where appropriate sealed according to the provisions of §471.003, *Florida Statutes* and §553.79, *Florida Statutes*. Such systems may include, but are not limited to, one of the following:

C501.1 Air pressure control. Indoor pressure may be elevated relative to subslab levels.

C501.2 Ventilation. An indoor air exchange rate may be maintained in a sufficient quantity to satisfy Section C502.1.

C502 Design criteria.

C502.1 Compliance. Any engineered radon mitigation system in compliance with this standard must maintain an indoor radon concentration equal to or less than the "not to exceed" radon exposure standard established by the Florida Department of Health during the primary hours of occupancy. The interior surfaces of buildings pressurized as the primary means of radon control, must be sealed to Section 606, Air Infiltration, and Chapter 13, Energy Efficiency Code for Building Construction, of the *Florida Building Code, Building*. The design values for total ventilation and air exchange rates for each space occupancy shall not exceed the minimums provided for each space occupancy classification in Chapter 4, Ventilation, of the *Florida Building Code, Mechanical* or the ASHRAE 62 Alternative. When these air quantities are not sufficient to maintain

indoor concentrations below the acceptable level, other mitigation options shall be used.

C502.2 Tests. The indoor radon concentration must be measured in accordance with Chapter 3 and certified as acceptable according to current Florida Department of Health's rules.

C502.3 System monitoring device. Any engineered system must have a mechanism installed to automatically indicate failure of the system to building occupants, which shall be either a visual device conveniently visible to building occupants, or a device that produces a minimum 60 db audible signal.

CHAPTER C601
SOIL DEPRESSURIZATION SYSTEMS

C601 General. This chapter provides minimum design and construction criteria for active soil depressurization systems. The operating soil depressurization system shall maintain under the building a pressure less than the indoor air pressure. Systems for buildings with slab on grade floors shall as a minimum comply with Section C603.1. Systems for buildings with off grade floors shall as minimum comply with Sections C603.2 or C604.

C602 Soil depressurization system installation criteria.

C602.1 Suction fans.

C602.1.1 Fan. Suction shall be provided by a fan, rated for continuous operation and having thermal overload with automatic reset features.

C602.1.2 Seal. The suction fan shall be designed and manufactured to provide an air-tight seal between the inlet and outlet ducts and the fan housing. The fan housing must remain air-tight at air pressure equal to the rated maximum operating pressure.

C602.1.3 Rating. The rating specific to system type shall apply (see Sections C603.1 and C603.2).

C602.1.4 Location. The suction fan shall be located where any leakage of air from the exhaust portion of the fan or vent system shall be into outside air. No pressurized portion of the vent system shall pass through conditioned space.

C602.1.5 Power supply. Electrical power shall be supplied to the fan in compliance with the provisions of the *National Electric Code* and any additional local regulations.

C602.2 System monitoring device. The soil depressurization system shall include a system monitoring device which shall be either a visual device, conveniently visible to building occupants, or a device that produces a minimum 60 db audible signal, activated by the loss of pressure or flow in the vent pipe.

C602.3 Vents.

C602.3.1 Material. Piping material shall be of any type approved by locally adopted codes for plumbing vents.

C602.3.2 Slope. The vent piping shall have a minimum slope of $^1/_8$ inch (3 mm) per foot in order to drain any condensation back to soil beneath the soil gas retarder. The system shall be designed and installed so that no portion will allow the excess accumulation of condensation.

C602.3.3 Terminals. Vent pipes shall be terminated in locations that will minimize human exposure to their exhaust air. Locations shall be above the eave of the roof. To prevent reentrainment of radon, the point of discharge from vents of fan-powered soil depressurization shall meet all of the following requirements: (1) be 10 feet (3048 mm) or more above ground level, (2) be 10 feet (3048 mm) or more from any window, door, or other opening (e.g., operable skylight, or air intake) into conditioned spaces of the structure, and (3) be 10 feet (3048 mm) or more from any opening into an adjacent building. The total required distance [10 feet (3048 mm)] from the point of discharge to openings in the structure shall be measured either directly between the two points or be the sum of measurements made around intervening obstacles. If the point of discharge is at or below any window, door, or other opening into conditioned spaces of the structure the total required distance [10 feet (3048 mm)] shall be measured horizontally between the two points.

C602.3.4 Labeling. All exposed components of the soil depressurization system shall be labeled "SOIL GAS SYSTEM" to prevent accidental damage or misuse. Labels shall be on a yellow band, two inches wide and spaced three feet apart on all components.

C602.3.5 Clearance. All vent piping shall be located in compliance with existing and applicable codes, with regards to clearances from mechanical equipment and flues and notching of structural members. No vent shall penetrate a fire wall or party wall.

C603 Soil depressurization system design criteria.

C603.1 Subslab depressurization systems. Depressurization systems in sands or other granular soils shall as a minimum and within the practical limits posed by the building, meet the following requirements:

C603.1.1 Arrangement. Within the practical limits posed by the building, suction points shall be distributed as nearly equally as possible, and as follows:

1. A maximum of 1,300 square feet (120 m^2) per suction point, and
2. Each required suction point shall be located not less than 6 feet (1829 mm) nor more than 18 feet (5486 mm) from the perimeter; and
3. Multiple suction points shall be located within 36 feet (10 973 mm) of each other.

C603.1.2 Pipe size. Suction pipe should be of a size appropriate to the air-flows of the system, a minimum of 1.5 inches (38 mm) in diameter at the fan, and shall

not be reduced between the fan outlet and the final termination point.

C603.1.3 Pits. Suction point pits excavated below the slab shall be sized to provide adequate pressure distribution beneath the slab. Dimensions of 22 inches (559 mm) in diameter and 11 inches (279 mm) deep, or excavation of 1 cubic foot (.02832m^3) of soil, shall be presumed to meet this requirement. Further the pit shall be filled with 1-inch (25 mm) size gravel.

C603.1.4 Rating. Suction fans must be capable of developing minimum flows appropriate to the system at 1-inch water column pressure. Fans producing 100 cubic foot per minute (cfm) (47 L/s) at 1-inch (.2488 kPa) water column pressure are presumed to meet this requirement.

C603.2 Submembrane depressurization systems.

C603.2.1 General. Submembrane soil depressurization systems are essentially the same as subslab depressurization systems, but without the cover of a concrete slab. The membrane shall be protected from wind uplift in accordance with locally adopted codes. Systems may be of suction pit or continuous ventilation mat design.

C603.2.2 Membrane soilgas retarder. A membrane soil-gas retarder shall consist of a 8 mil or thicker single ply polyethylene sheet or other sheeting material of equal or lower permeability and equal or greater strength. Place sheeting to minimize seams and to cover all of the soil below the building floor. Retarders must provide excellent environmental stress crack resistance, impact strength and high tensile strength including additives to retard polymer oxidation and UV degradation. Where pipes, columns or other objects penetrate the soil-gas retarder, it shall be cut and sealed to the pipe, column or penetration. All seams of the membrane shall be lapped at least 12 inches (305 mm). Punctures or tears in the membrane shall be repaired with the same or compatible material.

C603.2.3 Depressurization systems in sands or granular soils with suction pit design. Submembrane soil depressurization systems covering sand or other granular soils shall meet the requirements of Section C602.1, with the suction pits filled with 1-inch (25 mm) size gravel which shall be covered by $^1/_8$-inch (3.1 mm) thick steel plate, 16 gage corrugated sheet metal, or equivalent sheets of other termite resistant structural materials, in compliance with existing and applicable codes.

C603.2.4 Depressurization systems in sands or granular soils with continuous ventilation mat(s) design. Depressurization systems in sands or other granular soils and utilizing a continuous ventilation mat shall have at least 216 square inches (.14 m^2) of suction area per lineal foot and shall meet the following requirements:

603.2.4.1 Arrangement. Suction points shall be equally distributed as follows:

1. The suction point should be centrally located along the length of each unconnected strip of mat; and
2. Mat strips should be oriented along the central axis of the longest dimension of the crawlspace; and
3. A minimum of one strip shall be used for crawlspaces having widths up to 50 feet (15 240 mm) [Additional strips should be added for each additional crawlspace width of up to 50 feet (15 240 mm) width.]; and
4. The mat strip shall extend to not closer than 6 feet (1829 mm) of the inner stemwall at both ends of the building; and
5. A separate suction point and fan shall be installed for each 100 feet (30 480 mm) linear length of ventilation mat.

C603.2.4.2 Pipe size. Suction pipe shall be a minimum 3-inch (78 mm) diameter and shall be carried full size to the final termination point.

C603.2.4.3 Rating. Suction fans must be capable of developing minimum flows of at least 100 cfm (47 L/s) at 1-inch (.2488 kPa) water column pressure.

C604 Crawl space ventilation.

C604.1 Active ventilation of the crawlspace. Structures that rely upon active (fan-driven) ventilation of the crawl pace for radon control, shall utilize fans rated for continuous operation, and shall be equipped with a fan failure warning device as specified in Section 603.2, and shall have a thermal overload with automatic reset feature.

C604.1.1 Vents. Vents connecting the crawlspace with outside air shall be sized and located as required to provide mitigation of the indoor radon concentration as demonstrated by post-mitigation test, and shall not be equipped with operable louvers or other means for adjustment by building occupants. Where adjustable vents are used, they shall be permanently fixed in the proper adjustment by the mitigation contractor.

C604.1.2 Plumbing. Plumbing located in the crawlspace shall be adequately protected from freezing by insulation or means other than restriction of ventilation air.

APPENDIX D

FIRE DISTRICTS

RESERVED

APPENDIX E
Chapter 9 B-67 FLORIDA STANDARD FOR RADON-RESISTANT NEW COMMERCIAL CONSTRUCTION

9B-67.001 Purpose and intent.

9B-67.002 Definitions.

9B-67.003 Department activities.

9B-67.004 Florida Standard for Radon-Resistant New Commercial Building Construction, Adopted.

9B-67.001 Purpose and intent.

1. The provisions of this rule chapter are adopted to implement the Florida *Standard for Radon-Resistant New Commercial Building Construction* as mandated in Part X, Chapter 553, *Florida Statutes*, and are intended to provide standards for construction of radon-resistant commercial type new buildings, and to provide for the public safety, health and general welfare.
2. These rules and regulations prescribe standards for radon-resistant construction in commercial type new buildings in Florida, as may be adopted uniformly within counties by county and municipal ordinances. However, none of these provisions contained herein, or in the standards adopted, shall preclude or prohibit the owners of such buildings from exceeding these standards at their discretion.

Specific 553.98(2) FS, 1995 Supplement.
Law Implemented 553.98 FS.
History–New 2-27-96.

9B-67.002 Definitions.

For the purpose of this rule chapter, the following words, unless the text does not permit such meaning, shall have the meanings indicated:

1. Department–The Department of Community Affairs.
2. Exempted buildings–All buildings described in Items a through e are exempted from compliance with this standard. Buildings described in Item f are exempted from compliance with Sections 306 and 307 and Chapter 4 of the Florida *Standard for Radon-Resistant New Commercial Building Construction*. Elevated buildings that comply with all provisions of Item g are exempted from compliance with other portions of the Florida *Standard for Radon-Resistant New Commercial Building Construction*.
   a. Temporary structures.
   b. Free-standing greenhouses used exclusively for the cultivation of live plants.
   c. Open-air reviewing stands, grandstands and bleachers.
   d. Farm structures used only for storage or to shelter animals.
   e. Residential buildings defined as one- or two-family detached houses or townhouse apartments with no more than three stories.
   f. Buildings of occupancy classification S, Storage, or H, Hazardous (standard building code designations).
   g. Elevated buildings that satisfy all the following conditions: the structure separated from the ground by a vertical separation, measured between the final grade and the lower surface of the floor, of at least 6 feet (1829 mm); all contact between the structure and the soil consists of solid pilings, posts, piers or other supports with a total ground contact area of less than 5 percent of the horizontal projected area of the structure; all pilings, posts, piers or other supports are solid or sealed at the surface of the soil; enclosures that connect from the soil or a crawl space to the remainder of the structure comply with passive structural controls of the Florida *Standard for Radon-Resistant New Commercial Building Construction*; and the perimeter of the structure, from the ground plane to the lower surface of the lowest floor is totally open for ventilation.
3. Radon–A naturally occurring, chemically inert, radioactive gas. It is a part of the Uranium-238 decay series. Radon applies to Radon-222, and is a direct decay product of Radium-226.
4. Standard–The *Florida Standard for Radon-Resistant New Commercial Building Construction.*

Specific 553.98(2) FS, 1995 Supplement.
Law Implemented 553.98 FS.
History–New 2-27-96.

9B-67.003 Department activities.

1. The department shall provide incidental support to county and local governments implementing the Florida *Standard for Radon-Resistant New Commercial Building Construction*, to include:
   a. Interpret and clarify various aspects of the standard.
   b. Assist and provide technical support for analysis of proposed alternatives and innovations in construction to comply with this standard.
   c. Provide training on the use of the standard to building department personnel, builders, designers, and other interested persons or groups.
2. The department shall provide incidental support to persons and groups in the implementation of the Florida *Standard for Radon-Resistant New Commercial Building Construction,* to include:
   a. Support requests for information or interpretations regarding the application and administration of stan-

dards adopted herein; oral requests must be confirmed by the party in writing to the department.

b. Maintain design guidance computer model for use by building designers.

Specific 553.98(1) FS, 1995 Supplement.
Law Implemented 553.98 FS.
History–New 2-27-96.

9B-67.004 Florida Standard for Radon-Resistant New Commercial Building Construction, adopted.

1. The Florida *Standard for Radon-Resistant New Commercial Building Construction* is herein incorporated by reference. The Department shall maintain the Florida *Standard for Radon-Resistant New Commercial Building Construction.*
2. A copy of the above referenced standard has been filed with these regulations with the Secretary of State. The standard is also available for reference and inspection at the department offices in Tallahassee, Division of Housing and Community Development.

Specific 553.98(1) FS, 1995 Supplement.
Law Implemented 553.98 FS.
History–New 2-27-96.

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CHAPTER E101
GENERAL

E101 General. The design and construction requirements set forth in the following chapters and sections shall constitute and be known as the Florida *Standard For Radon-Resistant Commercial Building Construction*, hereinafter referred to as "this standard."

E102 Intent. This standard was developed in accordance with Section 553.98, *Florida Statutes*, to minimize radon entry into newly constructed commercial buildings, in compliance with the state health standard. The design, construction, and operation of buildings are governed by a variety of codes, standards, guidelines, and regulations. Nothing in this standard is intended to create a conflict with existing health and life-safety regulations.

E103 Scope.

E103.1 Applicability. The provisions of this standard shall apply to the design and construction of new commercial buildings and additions to existing commercial buildings, except single family and multiple-family residential buildings of three or fewer stories above grade and those identified in Section E104.3. When adopted by county and local government, this standard shall be applied uniformly countywide. This standard shall not be modified by a local government or building-regulatory agency.

E103.2 Additions. When the cost of an addition to an existing building exceeds 50 percent of the current value of the building; only the addition must be brought into compliance with all applicable portions of this standard, as defined in Section E104.

E104 Compliance.

E104.1 General. Buildings designed and constructed in accordance with all the applicable provisions of this standard are deemed to comply.

E104.2 New buildings and additions. All new commercial buildings and additions to existing buildings shall meet the following compliance requirements of this standard:

1. Compliance with existing local building codes and Chapter 13 of *Florida Building Code, Building*.
2. Use of methods described in Chapters 3 and 4 of this standard.

E104.3 Exemptions. All buildings described below in Items 1 through 5 are exempted from compliance with this standard. Buildings described in Item 6 are exempted from compliance with Sections E306 and E307, and Chapter 4 of this standard. Elevated buildings that comply with all provisions of Item 7 are exempted from compliance with other portions of this standard.

1. Temporary structures.
2. Free-standing greenhouses used exclusively for the cultivation of live plants.
3. Open-air reviewing stands, grandstands and bleachers.
4. Farm structures used only for storage or to shelter animals.
5. Residential buildings defined as one- or two-family detached houses or townhouse apartments with no more than three stories.
6. Buildings of occupancy classification S, storage, or H, hazardous (standard building code designations).
7. Elevated buildings that satisfy all the following conditions:
   a. The structure shall be separated from the ground by a vertical separation, measured between the final grade and the lower surface of the floor, of at least 18 inches (457 mm), and
   b. All pilings, posts, piers or other supports shall be solid, or if hollow, shall be capped by a solid masonry unit or sealed at the surface of the soil with a construction complying with all applicable portions of Chapter 3 of this standard, and
   c. Enclosures of any kind, including but not limited to chases, storage rooms, elevator shafts and stairwells, that connect between the soil and the structure, shall comply with all applicable provisions of Chapter 3 and shall have a soil contact area of less than five percent (5 percent) of the projected building floor area, and
   d. The perimeter of the structure, from the ground plane to the lower surface of the lowest floor shall be totally open for ventilation.

E104.4 Required documentation. In order to comply with this standard, all structures must include in the construction documents provided for permitting, a summary of the radon-resistant design strategies being implemented in the structure. Additionally, the building owner shall be provided with a manual substantiating the radon resistance features. This manual shall include: a summary of the radon-resistant design strategies incorporated into the structure, a listing of the design specifications for all relevant motor-driven systems; a maintenance schedule for maintaining design specifications, including active soil depressurization and heating, ventilating, and air conditioning systems; and a listing of all critical adjustments, such as intake-air damper settings.

CHAPTER E201
DEFINITIONS

E201 General. For the purpose of this Standard, certain abbreviations, terms, phrases, words and their derivatives shall be construed as set forth in this chapter. Words not defined herein shall have the meanings stated in the *Florida Building Code, Building; Florida Building Code, Mechanical;Florida Building Code, Plumbing; Florida Building Code, Fuel Gas; and Florida Fire Prevention Code*. Words not defined in these codes shall have the meanings in *Webster's Ninth New Collegiate Dictionary,* as revised. When cited throughout this standard, ASTM and ACI standards refer to the latest editions.

E202 Definitions.

ACTIVE SOIL-DEPRESSURIZATION. The lowering of air-pressure in the soil, relative to the atmospheric pressure immediately above ground level.

ACTIVE SOIL-DEPRESSURIZATION SYSTEM. A system designed to lower the air-pressure in the soil beneath a building, relative to the atmospheric pressure immediately above ground level, by continuously withdrawing air from below a membrane covering the soil. An active soil-depressurization system consists of a pressure distribution manifold, one or more radon vents, an operating fan, and a fan-failure indicator.

ADDITION. An extension or increase in floor area that can be occupied or that exchange air with the conditioned space of the building.

AND/OR. When referring to a choice of two or more provisions of this standard, signifies that use of any one provision is acceptable, and that two or more provisions may also be used together.

APPROVED. Accepted by the building official or other authority having jurisdiction.

AREA. The maximum horizontally projected area of a building or space, measured to the outside surface of the enclosing walls.

AUTOMATIC. Self-acting, providing an emergency function without human intervention, and activated as a result of a predetermined event such as an interruption of air-flow, a change in air-pressure, or the loss of electrical supply.

BACKER ROD. See "Backup."

BACKUP. A compressible material used in the bottom of sealant reservoirs to reduce the depth of the sealant, thus improving its shape factor. Backup also serves to support the sealant against sag or indentation while curing.

BLEACHERS. Tiered or stepped seating facilities without backrests in which an area of 3 square feet (.28 m^2) or less is assigned per person.

BUILDING. Any structure that encloses a space used for sheltering any occupancy. Each portion of a building separated from other portions by a fire wall shall be considered as a separate building.

BUILDING OFFICIAL. The officer or other designated authority, or their duly authorized representative, charged with the administration and enforcement of building codes.

BUTT JOINT. A nonbonded plain, square joint a keyed joint or a doweled joint between two members, where primarily movement is at right angles to the plane of the joint. Sealant in a butt joint will generally be in tension or compression, but not shear.

CAVITY WALL. A wall built of any combination of materials, so arranged as to provide a vertical air space within the wall.

COMMERCIAL BUILDING. A structure or building classified according to use by the standard building code as occupancy groups: A - Assembly, B - Business, E - Educational, F - Factory Industrial, I - Institutional, M - Mercantile, and R-Residential (except those already covered by the Florida *Standard for Passive Radon-Resistant New Residential Building Construction*).

CONTRACTION JOINT. A formed or sawed groove in a concrete structure, extending normal to the surface and to a depth of at least one-fourth the thickness of a concrete element, for the purpose of creating a weakened plane that induces a crack as internal stresses develop due to drying shrinkage.

CONSTRUCTION JOINT. The surface where two successive placements of concrete meet and are to be bonded; reinforcement is not interrupted and tie bars are used as required.

CONTROL JOINT. See "Contraction joint."

CRAWL SPACE. The unconditioned space between the bottom surface of the lowest floor of a structure and the earth, that is created when the lowest floor of the structure spans between structural supports rather than being directly supported by the earth beneath the floor.

CURING. For concrete, the maintenance of a satisfactory moisture content and temperature during its early stages so that desired properties may develop. For sealants, the maintenance of a satisfactory moisture content and temperature while the physical properties of the sealant are changed by chemical reaction.

CURING COMPOUND. A liquid that can be applied as a coating to the surface of newly placed concrete to retard the loss of water, or in the case of pigmented compounds, also to reflect heat so as to provide an opportunity for the concrete to develop its properties in a favorable temperature and moisture environment.

DETERIORATION. The physical manifestation of failure of a material or assembly (e.g. cracking, delamination, flaking, pitting, scaling) caused by environmental or internal autogenous influences during testing or service.

DIFFUSION. The movement of radon from areas of high concentration to areas of low concentration.

ELASTOMERIC SEALANT. A sealant whose macromolecular material returns rapidly to approximately its initial dimensions and shape after substantial deformation by a weak stress and release of the stress.

EMANATION. The gaseous elements produced by and given off from the radioactive disintegration of radium.

EQUILIBRIUM. The condition where the rate of decay of a radioactive parent isotope is exactly matched by the rate of decay of every intermediate daughter isotope.

EXISTING. As applied to a building or structure, one which was erected or permitted prior to the adoption of this standard.

FIELD-MOLDED SEALANT. A liquid or semisolid material molded into the desired shape in the joint into which it is installed.

FOOTING. That portion of the foundation of a structure which spreads and transmits load directly to the piles, or to the soil or supporting grillage.

FOUNDATION WALL. A wall below the first floor extending below the adjacent ground level and serving as a structural support for a wall, pier, column or other structural element.

GASKET. A deformable material clamped between essentially stationary faces to prevent the passage of air through an opening or joint.

GRADE. The top surface of the ground adjoining the exterior of a building.

GRADE BEAM. A reinforced concrete beam, usually at ground level, to form a foundation for the walls of a superstructure.

GRANDSTANDS. Tiered or stepped seating facilities where an area of more than 3 square feet (.28 m^2) is provided for each person.

GRANULAR SOIL. A soil with an air permeability greater than or equal to 10^{-12} m^2.

GROUT. A mixture of cementitious material and water, with or without aggregate, proportioned to produce a pourable consistency without segregation of the constituents.

HIGH-RANGE WATER REDUCER. A chemical admixture capable of reducing the water content of concrete at least 12 percent. This admixture shall conform to ASTM C 494 Type F and/or Type 0.

HOLLOW MASONRY WALL. A wall built of masonry units so arranged as to provide an air space within the wall.

HONEYCOMB. Voids left in concrete due to failure of the mortar to effectively fill the spaces among course aggregate particles.

ISOLATION JOINT. A nonbonded separation between adjoining parts of a structure, usually in a vertical plane, designed to allow relative movement in three directions in order to accommodate differential horizontal or vertical movement without the development of cracks elsewhere in the structure. May be either a butt joint or a lap joint, used to structurally separate the floor slab from other building elements.

KEYED. Fastened or fixed in position in a notch or other recess.

KEYWAY. A recess or groove in one lift or placement of concrete which is filled with concrete of the next placement, providing improved shear resistance at the joint.

LAITANCE. A layer of weak and nondurable material containing cement and fines from aggregates, brought by bleeding water to the outer surface of concrete.

LAP. The length by which one material overlays another at a lap joint.

LAP JOINT. A nonbonded joint in which the materials being joined override each other so that any movement of the materials is primarily parallel to the plane of the joint, putting sealants in shear rather than tension or compression. Formed slab joints that are not attached with a keyway are considered to be lap joints.

MANUFACTURED SANDS. Sands resulting from the crushing of rock, gravel or slag.

MASONRY. Construction composed of shaped or molded units, usually small enough to be handled by one person and composed of stone, ceramic brick or tile, concrete, glass, adobe, or the like.

MASTIC. A sealant with putty-like properties.

MEMBRANE. A flexible, continuous sheet. See also: "Membrane-forming," "wring compound," "Soil-gas-retarder membrane;" "Waterproofing membrane."

MEMBRANE-FORMING CURING COMPOUND. A liquid material that, when applied over the surface of freshly placed concrete, forms a solid, impervious layer which holds the mixing water in the concrete.

MIDRANGE WATER REDUCER. A chemical admixture capable of reducing the water content of concrete from 6 to 15 percent. This admixture shall conform to ASTM C 494 Type A and/or Type F.

NATURAL SANDS. Sands resulting from the natural disintegration and abrasion of rock.

NET-FREE AREA. When referring to foundation vents, the area determined by multiplying the overall width and height of the object and subtracting the total area obstructed by any solid object, such as screen, mesh, louvers, and frame of the vent.

OPEN AIR. When referring to reviewing stands, grandstands and bleachers, indicates a seating facility in which the side toward which the audience faces is without an enclosing wall.

PICOCURIES PER GRAM. pCi/g, a measure of radioactivity corresponding to 0.037 radioactive disintegrations per second per gram of dry weight of a sample.

PICOCURIES PER LITER. pCi/L, a measure of radioactivity corresponding to 0.037 radioactive disintegrations per second per liter of volume.

PLASTICIZER. See "Midrange water-reducer."

POLYETHYLENE. A thermoplastic high-molecular-weight organic compound often used in sheet form as a water-vapor retarder.

POLYURETHANE SEALANT. A building sealant consisting primarily of a polyurethane compound.

POLYVINYL CHLORIDE. A synthetic resin used in the manufacture of pipes and nonmetallic waterstops.

PREFORMED SEALANT. A sealant functionally preshaped by the manufacturer so that only a minimum of field fabrication is required prior to installation.

PRESSURE SENSITIVE. Capable of adhering to a surface without the application of additional adhesives, when pressed against it.

PSI. Pounds force per square inch.

RADIUM (Ra). A naturally occurring radioactive element resulting from the decay of uranium. For the purposes of this standard, radium applies to Radium-226. It is the parent of radon gas.

RADON. A naturally occurring, chemically inert, radioactive gas. It is part of the Uranium-238 decay series. For the purposes of this standard radon applies to Radon-222; thus, it is the direct decay product of Radium-226.

RADON POTENTIAL. A measure of the potential of soils at a building site for contributing to indoor radon concentrations.

SEALANT. Any material used to seal joints or openings against passage of solids, liquids, or gases.

SHAFT. A vertical opening extending through one or more stories of a building, for utilities, an elevator, dumbwaiter, light, ventilation, plumbing or electrical installation or a similar purpose.

SHAPE FACTOR. The relationship between the depth and width of a field-molded sealant.

SOIL-GAS-RETARDER MEMBRANE. A durable, flexible and non-deteriorating material, installed in a continuous sheet to retard the pressure-driven flow of soil gas through elements of a structure.

SOLID REINFORCED MASONRY. Masonry construction in which mortar, grout or concrete completely fills all joints and voids and in which steel reinforcement is embedded in such a manner that the materials act together in resisting forces.

STORY. That portion of a building between the upper surface of a floor and the upper surface of the floor or roof next above.

STRUCTURE. That which is built or constructed. A structure may contain one or more buildings separated by fire-rated construction elements in accordance with prevailing building codes.

SUBGRADE. The soil prepared and compacted to support a structure.

SUPERPLASTICIZER. See "High-range water reducer."

SUPERSTRUCTURE. All of that part of a structure that is above grade.

TEMPORARY STRUCTURE. A structure which is erected, occupied, and disassembled or otherwise removed from the site within a total time period of 90 calendar days or less.

WATERPROOFING MEMBRANE. A liquid sealing compound (e.g., bituminous and paraffinic emulsions, coal tar cut-backs, etc.) or nonliquid protective coatings (e.g., sheet plastics, etc.) used separately or together in a manner which renders the structural surface to which they are applied essentially impervious to water in either the liquid or vapor state.

WATER-REDUCING ADMIXTURE. A chemical additive to concrete conforming to ASTM C 94 capable of producing a reduction in mixing water or increase in flowability without causing undue set retardation or entrainment of air in the mortar or concrete.

WATERSTOP. A diaphragm used across a joint as a sealant, usually manufactured specifically to prevent the passage of water through joints in concrete structures.

WORKING LEVEL (WL). A measure of radioactive exposure equal to the total quantity of radon decay products in one liter of air that will result in the ultimate emission of 1.3 x 105 MeV (million electron volts) of energy from alpha particles. In perfect equilibrium, 1 WL equals 100 pCi/L (picoCuries per liter). It is often assumed that the air inside buildings is not in equilibrium, and that only half the radon daughters are moving freely in the air, while half are attached to dust or building surfaces. When this condition exists, an equilibrium ratio of 0.5 is said to exist. At an equilibrium ratio of 0.5, 1 WL = 200 pCi/L. For purposes of this standard, 1 WL is defined as equal to 200 pCi/L.

ZONE. That portion of a building in which the HVAC system is controllable from a single point.

CHAPTER E301
CONSTRUCTION REQUIREMENTS FOR PASSIVE CONTROLS

E301 General. Construction to these standards will limit radon entry points through building floors, walls, and foundations and will limit mechanical depressurization of buildings, which can enhance radon entry. Structural radon barriers are primarily intended to stop the pressure-driven flow of soil-gas through unsealed cracks and openings in the foundation and/or floor and into the building. Barriers can also be effective in controlling the diffusion of radon through materials and the emanation of radon from materials. An acceptable degree of redundancy and reliability is achieved only when these components are implemented as part of an integrated system of radon-resistance as prescribed by this standard. All structures shall be isolated from the soil by an approved structural barrier as defined by the applicable portions of this standard. No crack, joint, duct, pipe, conduit, chase or other opening in the building foundation or floor shall be allowed to connect soil-gas to a conditioned space or to the interior space of an enclosed space that is either adjacent to, or connected to, a conditioned space.

E302 Soil-gas-retarder membrane.

E302.1 Membrane materials. Acceptable soil-gas-retarder membranes shall consist of a single layer of polyethylene, not less than 0.006-inch (6 mils) thick with a maximum perm rating of 0.3. Polyvinyl chloride (PVC), ethylene propylene diene ter polymer (EPDM), neoprene or other nondeteriorating, non-porous material may be used instead of polyethylene, provided the installed thickness of the alternate material has greater or equal tensile strength, resistance to water-vapor transmission, resistance to puncture, and resistance to deterioration determined in accordance with ASTM E 154. The membrane shall be placed to minimize seams and to cover all of the soil below the building floor.

E302.2 Tape. Tape used to install the soil-gas retarder shall have a minimum width of 2 inches (51 mm) and shall be pressure sensitive vinyl or other non-deteriorating pressure sensitive tape compatible with the surfaces being joined. Paper tape and/or cloth tape shall not be used for these purposes.

E302.3 Mastic. Mastic used to install the soil-gas retarder shall be compatible with the surfaces being joined, and shall be installed in accordance with the manufacturer's recommendations for the materials, surface conditions and temperatures involved. Mastic may be used to join sections of membrane to one another or to elements of the building foundation, or to seal penetrations in the membrane.

E302.4 Installation. The soil-gas retarder shall be placed under the entire soil-contact area of the floor in a manner that minimizes the required number of joints and seams. Care shall be taken to prevent damage to the membrane during the construction process. In buildings incorporating the

subslab portions of an active soil-depressurization system, the soil-gas retarder serves an important second purpose: to prevent mastic, cement or other materials from blocking the pressure distribution manifolds or pits.

E302.5 Seams. Seams between portions of the soil-gas retarder shall maintain a minimum of 12 inches (305 mm) of lap when concrete is placed. This may be accomplished by securing the lapped edges of the membrane with tape or mastic or using larger unsecured overlaps prior to placing concrete.

E302.6 Slab edges and joints. The soil-gas retarder shall fully cover the soil beneath the building floor. Where the slab edge is cast against a foundation wall or grade beam, the soil-gas retarder shall contact the foundation element, and shall not extend vertically into the slab more than one half the slab thickness.

E302.7 Penetrations. At all points where pipes, conduits, reinforcing bars or other objects pass through the soil-gas-retarder membrane, the membrane shall be fitted to within $^1/_2$ inch (12.7 mm) of the penetration and sealed to the penetration. When penetrations occur within 24 inches (610 mm) of a soil-depressurization-system mat or pit, the gap between the penetrating object and the soil-gas retarder shall be taped closed. When necessary to meet this requirement a second layer of the membrane, cut so as to provide a minimum 12-inch (305 mm) lap on all sides, shall be placed over the object and shall be sealed to the soil-gas retarder with a continuous band of tape.

E302.8 Punctures, cuts and tears. All damaged portions of the soil-gas-retarder membrane within 24 inches (610 mm) of any portion of a soil-depressurization-system mat or pit shall be sealed with tape or with a patch made from the same or compatible material, cut so as to provide a minimum 12-inch (305 mm) lap from any opening, and taped continuously about its perimeter.

E302.9 Mastics. Mastic may be used to join sections of soil-gas retarder to one another or to elements of the building foundation, or to seal penetrations in the soil-gas retarder, provided that mastic is kept at least 24 inches (610 mm) from any portion of a soil-depressurization-system mat or pit. Only tape may be used to seal the soil-gas-retarder membrane within 24 inches (610 mm) of a soil-depressurization-system mat or pit.

E302.10 Repairs. Where portions of an existing slab have been removed and are about to be replaced, a soil-gas-retarder membrane shall be carefully fitted to the opening, and all openings between the membrane and the soil closed with tape or mastic. Special care must be exercised to assure that mastic does not enter any portion of a soil-depressurization system located beneath the slab.

E303 Concrete floors in contact with soil-gas.

E303.1 General. Concrete slabs supported on soil or spanning over exposed soil, that are used as floors for conditioned space or enclosed spaces adjacent to or connected to conditioned spaces, shall be constructed in accordance with the following provisions of Section E303.

E303.2 Concrete for slabs.

E303.2.1 Compressive strength. Design strength for all concrete mixes used in the construction of slab-on-grade floors shall be a minimum of 3,000 psi (21 MPa) at 28 days and shall be designed, delivered and placed in accordance with ASTM C 94.

E303.2.2 Shrinkage control. In order to limit the uncontrolled cracking of floor slabs, the concrete mix design, placing practices, and curing practices prescribed in this section shall be followed. All concrete slabs-on-grade or slabs spanning above exposed soil shall be designed, placed, finished, and cured in accordance with local governing codes and applicable portions of ACI 318, *Building Code Requirements for Reinforced Concrete*; ACI 302, *Guide for Concrete Floor and Slab Construction*; and if fiber-reinforced concrete is used, the recommendations of the ACI Committee 544, *State of the Art Report on Fiber Reinforced Concrete*. ACI 302 and 544 may not be incorporated by reference for design.

E303.2.3 Mix design. Mix design for all concrete used in the construction of slab on grade floors shall specify a maximum design slump not to exceed 4 inches (102 mm). On-site slumps shall not exceed 5 inches (127 mm), provided that the total water added to the mix, including plant, transit, and site added water does not exceed the total following parameters:

1. For mixes using only natural sands, water content shall not exceed 275 pounds per cubic yard of concrete.
2. For mixes using manufactured sands, water content shall not exceed 292 pounds per cubic yard of concrete.

E303.2.4 Slump and workability. For concretes that do not contain midrange or high-range water-reducers, concrete slump measured at the point of placement in accordance with ASTM C 172, shall not exceed 5 inches (127 mm). For concretes designed and mixed containing mid-range or high-range water-reducers conforming with ASTM C 494, slump measured at the point of placement in accordance with ASTM C 172, shall not exceed 7 inches (178 mm) for mid-range and 8 inches (203 mm) for high-range water reducers.

E303.2.5 Hot weather placing and finishing. All concrete shall be placed and finished in accordance with the provisions of ACI 301, *Specifications for Structural Concrete for Buildings*. When necessary, provision for wind breaks, shading, fog spraying, sprinkling, ponding or wet covering with a light colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.

E303.2.6 Curing. Concrete floors shall be cured by one of the means described below and shall not be subjected to loading until the architect or engineer has de-

termined the slab to be structurally adequate for the loads imposed.

1. Concrete floor slabs shall be cured by covering the entire slab surface for a period of seven days with clean, ponded water.
2. Concrete floor slabs shall be cured by covering the entire slab surface for a period of seven days with a continuous mist or spray of clean, potable water.
3. Concrete floor slabs shall be cured by covering the entire slab surface for a period of seven days with an impermeable sheet material conforming to ASTM C 171.
4. Concrete floor slabs shall be cured by covering the entire slab surface with a liquid membrane-forming compound that conforms with ASTM C 309. Curing compounds shall be compatible with materials specified in Section E303.3.1.

E303.3 Sealing of construction joints, penetrations, cracks, and other connections.

E303.3.1 Sealants. Sealants shall be selected and installed in compliance with ASTM C 920, *Standard Specification for Elastomeric Joint Sealants*, and ASTM C 1193, *Standard Guide for Use of Joint Sealants*.

1. Sealant materials shall be compatible with the materials they join, including curing compounds and admixtures, and with materials that will be applied over them, including floor finishing materials.
2. Field-molded sealants shall be installed in sealant reservoirs proportioned, cleaned of laitance and prepared in accordance with the manufacturer's recommendations. For elastomeric sealants, this generally requires the installation of a bond breaker or backer rod.
3. When the installed sealant is not protected by a finished floor or other protective surface, it shall be suitable to withstand the traffic to which it will be exposed.
4. Waterstops shall be preformed from polyvinyl chloride or other noncorrosive material and shall be selected and installed in compliance with ACI 504R

E303.3.2 Joints. All joints between sections of concrete floor slabs, between the floor slab and a wall or other vertical surface, or between a section of floor and another object that passes through the slab, shall be sealed to prevent soil-gas entry in accordance with the provisions of this section. Joint design depends upon the amount and type of movement that the joint must withstand. Ideally, sealing should occur as late in the construction process as possible. No portion of any joint shall be covered or rendered inaccessible unless the seal has first been inspected and approved by the building official. All such joints shall be sealed prior to the structure being certified for occupancy.

1. Butt joints. All nonbonded butt joints shall be sealed to prevent radon entry using an elastomeric sealant or a waterstop specified above. The sealant reservoir shall be sufficiently large to prevent failure of the sealant or waterstop, but in no case shall the sealant reservoir be less than $^1/_4$ inch by $^1/_4$ inch (6.4 mm by 6.4 mm) in cross section
2. Lap joints. All nonbonded lap joints shall be sealed with either a field-molded or preformed elastomeric sealant or with a flexible waterstop as specified above. The lap joint shall be sufficiently large to prevent failure of the sealant or waterstop, but in no case shall the sealant reservoir be less than $^1/_2$ inch by $^1/_2$ inch (12.7 mm by 12.7 mm) in cross section.
3. Isolation joints. All nonbonded isolation joints shall be sealed with either a field-molded or preformed elastomeric sealant or with a flexible waterstop as specified above. Isolation joints shall be sufficiently large to prevent failure of the sealant or waterstop, but in no case shall the sealant reservoir be less than $^1/_2$ inch by $^1/_2$ inch (12.7 mm by 12.7 mm) in cross section.
4. Control or contraction joints. May be used to limit unplanned cracking of floor slabs. In locations where continued movement of the slab portions can be reasonably expected, flexible sealants must be installed in reservoirs complying with the requirements of above section on butt joints, or a flexible waterstop must be used.
5. Construction joints. All bonded construction joints shall be sealed to prevent radon entry using either a rigid or an elastomeric sealant or a waterstop as specified above. Where movement of the joint is not prevented by continuous reinforcing and tie bars, flexible sealants must be installed in reservoirs complying with the requirements of above section on lap joints, or a flexible waterstop must be used.

E303.3.3 Cracks. All cracks in concrete slabs supported on soil or spanning over exposed soil, that are used as floors for conditioned space or enclosed spaces adjacent to or connected to conditioned spaces, shall be sealed against radon entry in accordance with the provisions of this section and Section E303.3.1. Ideally, sealing should occur as late in the construction process as possible.

1. Cracks greater than $^1/_4$ inch (6.4 mm) wide; all cracks that exhibit vertical displacement; all cracks that connect weakened zones in the slab such as vertical penetrations or re-entrant corners; and, all cracks that cross changes in materials or planes in the structure, shall be sealed with a flexible field-molded elastomeric sealant installed in accordance with above section on Isolation Joints.

2. Cracks greater than $^1/_{16}$ inch (1.6 mm) in width, that do not meet any of the conditions described in Item 1 above, shall be enlarged to contain a sealant reservoir not less than $^1/_2$ inch by $^1/_4$ inch (12.7 mm by 6.4 mm) in cross-section along the entire length of the crack; and shall be sealed with a flexible, field-molded elastomeric sealant installed in accordance with above section on butt joints.
3. Cracks less than $^1/_{16}$ inch (1.6 mm) in width, that do not meet any of the conditions described in Item 1 above, may be left unsealed.

E303.3.4 Stakes, pipe penetrations and other small objects. All objects that pass through the slab shall be sealed gas tight. A sealant reservoir, appropriately dimensioned to accommodate any differential movement between the object and the concrete, shall be formed continuously around the object, and the joint shall be sealed with a field molded elastomeric sealant as prescribed for isolation joints and in accordance with the provisions of Section E303.3.1. Where pipes or other penetrations are separated from the concrete by flexible sleeves, the sleeve shall be removed to provide bonding of the sealant to the object. Where stakes are used to support plumbing, electrical conduits or other objects that will penetrate the slab, the stakes shall be solid, non-porous and resistant to decay, corrosion and rust. Special care must be taken to avoid honeycombing between multiple or ganged penetrations.

1. Large utility service openings through the slab shall be sealed gas-tight. For slab-on-grade construction, this can be accomplished by fully covering the exposed soil with a vapor-retarder membrane, covered to a minimum depth of 1 inch with an elastomeric sealant. Alternatively, the opening may be closed with an expansive concrete or hydraulic cement to within $^1/_2$ inch (12.7 mm) of the top of the slab, and the remaining $^1/_2$ inch (12.7 mm) filled with an elastomeric sealant. When the opening connects to a crawlspace, the opening shall be closed with sheet metal or other rigid impermeable materials and sealed with an elastomeric sealant compatible with the materials and conditions.
2. For openings made through existing slabs, they must be sealed to meet the appropriate provisions of this section. If the opening is partially repaired with concrete, any resulting crack shall be sealed in accordance with the Section E303.3.3.
3. Any sump located in a habitable portion of a building and connecting to the soil, either directly or through drainage piping, shall be fined with a gasketed lid. The lid shall be attached so as to provide a gas-tight seal between the sump and the access space above.

E304 Walls in contact with soil-gas.

E304.1 General. Walls separating below-grade conditioned space from the surrounding earth or from a crawlspace or other enclosed volume with an exposed earth floor, shall be isolated from the soil by an approved structural baffler as described in Section E302 of this standard. Foundation walls consisting of cavity walls, or constructed of hollow masonry products or of any material in such a way as to create an air-space within the wall, shall be capped at the floor level of the first finished floor they intersect. The cap shall be either at least 8 inches (203 mm) of solid concrete or concrete filled block, or a cap that provides airflow resistance at least equal to the adjacent floor. No crack, honeycomb, joint duct, pipe, conduit chase or other opening in the wall shall be allowed to connect soil-gas to a conditioned space or to an enclosed space adjacent to or connected to a conditioned space.

E304.2 Materials. Walls governed by the provisions of this section shall be constructed of reinforced concrete, or solid reinforced masonry construction.

E305 Buildings with crawl spaces.

E305.1 General. For the purpose of this standard, buildings with crawl spaces include all buildings with the floor supported above grade.

E305.1.1 Reinforced concrete floor systems. A reinforced concrete floor constructed over crawl spaces shall conform to all applicable provisions of Section E304.

E305.1.2 Wood-framed floor systems. Wood-framed floors spanning over soil, that are used as floors for conditioned space or enclosed spaces adjacent to or connected to conditioned spaces, shall be constructed in accordance with the provisions of this section.

E305.2 Materials. Wood-framed floors constructed over a crawl space shall be constructed of American Plywood Association (APA) certified tongue-in-groove plywood, and otherwise comply with Paragraph 4.1.2 of Appendix C to Chapter 13 of the *Florida Building Code, Building*. Oriented structural board shall not be an acceptable substitute material.

E305.3 Utility penetrations. All penetrations through the floor, including but not limited to plumbing pipes and wiring, shall be fully sealed to the floor structure with approved sealant materials as per Section E303.3.1. Large service openings through the slab, such as beneath bath tub drains, shall be sealed gastight. Where large openings are created, sheet metal or other rigid materials shall be used in conjunction with sealants to close and seal the openings.

E305.4 Vertical joints. All vertical joints between the subfloor and foundation wall or the subfloor and any vertical plane of the building which extends from the crawlspace to the top of the subfloor, shall be sealed with an approved sealant (see Section E303.3.1).

E305.5 Doors and service openings. Doors, hatches or removable closures of any kind that can create an opening in the floor-plane should be avoided, but when required, shall be gasketed and installed with a latch or other permanent fastening device.

E305.6 Other radon-entry paths. All openings which connect a crawlspace and construction cavities, such as the space between wall studs, hollow masonry or precast concrete units, or floor and ceiling planes, shall be closed and sealed with an approved sealant (see Section E303.3.1).

E305.7 Crawl space ventilation. Crawl spaces shall be passively ventilated or shall be constructed with an active soil-depressurization system in compliance with Chapter 4. No portion of an air distribution system shall pass through a crawlspace.

E305.7.1 Required ventilation. Crawl spaces shall be ventilated by openings through the perimeter wall connecting to the exterior of the foundation. Required vents shall have a combined net free area not less than 1 square inch (.000645 m^2) per 1 square foot (.0929 m^2) of crawl space, and shall conform to the following conditions:

1. Openings shall be distributed uniformly around the outside walls of the crawl space.
2. Vents shall be fitted with corrosion-and decay-resistant wire mesh or grilles with openings not less than $^1/_4$ inch (6 mm) nor more than $^1/_2$ inch (12.7 mm) in size. Vents shall not be fitted with operable louvers, dampers, or other closure mechanisms.
3. Plumbing located in a ventilated crawlspace shall be protected from freezing with insulation and/or heat tape.

E305.7.2 Prohibited uses. Crawl spaces shall not be used as an air-duct or plenum or to house any duct or fan that is part of a heating, ventilating or air-conditioning system.

E306 Space conditioning systems and ventilating.

E306.1 General. All heating, ventilating and air-conditioning systems shall be designed, installed, inspected and maintained in accordance with ANSI/ASHRAE 62-1989, *Ventilation for Acceptable Indoor Air Quality*, Chapter 13 of the *Florida Building Code, Building*, and with the provisions of this section. Construction to the provisions of this section will limit radon entry points through mechanical depressurization of buildings, which can enhance radon entry. Additionally, ventilating systems shall be designed to meet all applicable codes and the provisions of this section for use of outside air of low radon concentration.

E306.2 Condensate drains. All joints in condensate piping shall be solvent welded, soldered, or otherwise connected in a leakproof and gas-tight manner. Condensate drains shall be trapped and terminate in the building sewer or outside the building, a minimum of 6 inches (152 mm) above finished grade. If the condensate piping penetrates a floor or wall separating enclosed space from the soil or from a crawl space, the penetration shall be sealed in accordance with the applicable provisions of Chapter 3. The condensate drain piping shall not terminate in a return plenum.

E306.3 Other piping. When any piping penetrates a floor or wall separating enclosed space from the soil or from a crawl space, the penetration shall be sealed in accordance with the applicable provisions of Chapter 3. In the case of insulated piping, the insulation must be removed at the point of the seal, and required seal must be made between the pipe and the building structure. Sealant must be compatible with the materials and anticipated operating temperatures. Piping shall not terminate in a return plenum.

E306.4 Plumbing and wiring chases. Wherever piping or wiring is installed in a chase that is at any point in contact with the soil or a crawl space, the chase shall be sealed to the floor or wall where it first enters the structure, in accordance with the applicable portions of Chapter 3. Piping contained in such a chase shall be sealed to the chase at the interior plane of that floor or wall. No portion of any chase shall terminate in a return air duct or plenum. Where it is impractical or prohibited by another code to seal wiring into an electrical chase or conduit, the chase shall comply with all applicable portions of Chapter 3 or the conduit shall be entirely fabricated of gas-tight components and materials.

E307 Air distribution systems.

E307.1 Air distribution systems. Any air duct, plenum, fan enclosure, or fan that is part of a building's heating, ventilating or air-conditioning system shall be completely isolated from the soil-gas by a structural barrier complying with the provisions of Chapter 3. Heating, ventilating, and air conditioning systems supplying spaces that have floors or walls in contact with soil or soil-gas shall be designed to minimize air-pressure differences and eliminate negative pressures, that cause significant flow of soil-gas through the structural barrier and into the building. Return ducts, plenums, and air handlers shall not be located in a crawl space.

E307.2 Exhaust fans, hoods, equipment, and appliances. For each zone, the required volume of outside ventilation air shall be equal to or greater than the combined volume of air capable of being exhausted by all exhaust fans, hoods, equipment, and appliances installed in the zone. This amount may not be reduced by use factors unless devices are wired and switched in a manner that prevents their simultaneous operation.

E307.3 Combustion air ducts. Ducts that provide combustion air to fuel-burning appliances and equipment shall be completely isolated from the soil-gas by a structural barrier complying with the provisions of Chapter 3.

CHAPTER E401
ACTIVE SOIL-DEPRESSURIZATION SYSTEMS

E401 General. A soil-depressurization system maintains a lower air pressure in the soil directly beneath the building floor and foundation than exists within the building. This not only draws radon away, but also causes the direction of the airflow through any possible failure in the structural barrier to be out of the building and into the soil-depressurization system. Soil depressurization systems may be installed beneath concrete slabs supported directly on the soil, or beneath the soil-gas-retarder membrane in crawl spaces.

E401.1 Prohibited uses. Soil-depressurization systems components may not extend beneath areas that are required to be depressurized by other codes for the protection of public health, for example rooms containing general anesthesia,

pathogens, or poisonous chemicals. Soil depressurization systems may be installed beneath rooms that are required to be depressurized for other reasons, such as toilets and kitchens.

E402 System components. An active soil-depressurization (ASD) system is comprised of the following components: pressure distribution system porous media or manifolds; a soil cover; one or more vents; a suction fan; and a system failure indicator.

E402.1 Pressure distribution media or manifolds. A wide variety of means can be utilized to extend the low-pressure zone across the entire area beneath the structure. Acceptable means include synthetic ventilation mats, a system of perforated pipe, and an air-permeable gravel layer. Different types of pressure distribution media may be used in the same system, provided each complies with the installation requirements of this chapter. Pressure distribution media must be installed is such a way as to assure that they are never blocked by water.

1. Ventilation mats shall have a soil contact area of at least 216 square inches (.14 m^2) per lineal foot and provide a cross-section profile of at least 9 square inches (006 m^2).
2. Perforated pipe may be used to construct pressure extension manifolds. These pipes may be installed directly under the soil cover or in gravel or a similar porous medium that provides an adequate airflow connection between the pipe and the subsoil and that protects the pipe from becoming blocked by soil.
3. Continuous gravel layers of at least 4 inches (102 mm) thick are an acceptable pressure distribution medium, provided they completely cover the area of soil to be depressurized.

E402.2 Soil cover. In slab-on-grade construction, the soil cover consists of the soil-gas-retarder membrane and the concrete slab. In crawl spaces, the concrete slab may be omitted, providing the soil-gas-retarder membrane will not be subjected to wear and damage due to required maintenance procedures. In all instances, the soil-gas-retarder membrane shall be fully sealed to the radon vents in accordance with the provisions of Section E302.

E402.3 Radon vents. Radon vents are gas-tight pipes that carry the soil-gas to an area above and away from the building. Radon vent pipes shall be of a material approved by the governing local building code for plumbing vents.

E402.4 Suction fans. Suction fans create the critical pressure difference between the subslab and indoors. Suction fans shall be designed for continuous operation. Fan performance is determined by the soil characteristics, the airflow characteristics of the pressure distribution system, and the system layout, and shall comply with the airflows and operating pressures determined by the system design, as determined using the large-building active soil-depressurization model, or with criteria below for alternate compliance method. The computer model program is available through the Department of Community Affairs, Codes and Standards, 2555 Shumard Oak Blvd. Tallahassee, Florida, 32399-2100, (850) 487-1824.

E402.5 Fan-failure indicator. Each soil-depressurization system shall have a failure indicator labeled with the words "RADON REDUCTION SYSTEM FAN FAILURE INDICATOR" mounted so as to be conveniently visible to the building occupants. The fan-failure indicator may be either a visual device consisting of a light of not less than $^1/_5$ footcandle (2 lux) at the floor level, or an alarm that produces a minimum 60 db audible signal. The indicator shall be made to operate automatically when the pressure inside any radon vent pipe fitted with an operable fan is less than 0.40-inch water column (100 pascals) lower than the air pressure inside the building.

E403 ASD system design requirements.

E403.1 General. All ASD systems must comply with a design shown by the large-building active soil-depressurization model to be capable of maintaining a 0.02-inch (5-pascal) pressure differential over 90 percent of the slab or crawlspace area.

E403.2 Ventilation mat systems. Mat systems may be designed and installed in accordance with a design shown by the large-building active soil-depressurization model to be capable of maintaining a 5-pascal pressure differential over 90 percent of the slab area or with Section 503.2.2.

E403.2.1 Installation. Radon ventilation mats shall be installed immediately prior to placing the soil-gas-retarder membrane, to reduce the chance for soil to enter and block the mat. Mats shall be arranged in a pattern that provides at least two possible flow paths from any point on the mat to a radon vent pipe. Mats shall be placed with the filter material facing the compacted soil. Where sections of mat join, a minimum 6-inch (152 mm) long section of filter material at the end of one of the mats shall be loosened and the other piece of mat inserted between the loosened filter material and the first section of mat. The mats will be pressed tightly together at this lap and mechanically attached together with hog rings or metal pins driven through the mat and into the soil. Wire ties, which will puncture or tear the soil-gas-retarder membrane, shall not be used to join the mats. When properly joined, the filter material will extend continuously across the joint and the full cross-sectional area of the mat will be preserved across the splice.

E403.2.2 Alternate compliance method. Systems installed on sand or granular soil, can demonstrate compliance by meeting the following design limits:

1. Mats shall be located at least 15 feet (4572 mm) and not more than 25 feet (7620 mm) from the outside edge of the floor.
2. Mats shall be spaced not more than 50 feet (15 240 mm) on center.
3. No portion of a building floor shall be isolated from a mat by a construction feature, such as an internal footing, grade beam, foundation wall, or

other obstacle having a depth greater than the exterior foundation walls.

4. No portion of a building floor shall be more than 35 feet (10 668 mm) from a mat.
5. Mats shall be run parallel to the longest slab dimension unless obstructed by a construction feature, and arranged in a pattern that provides at least two possible flow paths from any point on the mat to a radon vent pipe.

E403.2.3 Radon vent connection. The radon vent pipe shall join to the mat in a manner that does not restrict the full air-flow capacity of the pipe. Depending upon the thickness and effective net-free-area of the ventilation mat, this may require enlarging the diameter of the vent pipe at the connection with a suitable flange, or increasing the net-free-area of the mat by installing additional layers of mat or a layer of gravel beneath the connection point. The soil-gas-retarder membrane shall be fully sealed to the radon vents in accordance with the provisions of Section 302.

E403.3 Perforated pipe systems. Perforated pipes shall be of a material approved by the governing local building code for foundation drainage, and sized according to the air-flow estimated from the large-building active soil-depressurization model. Where perforated pipes are installed in gravel meeting ASTM D 448, numbers 4 or 5 gravel, with not more than 5 percent passing a $^3/_8$ inch (10 mm) screen.

E403.3.1 Installation. Perforated pipe pressure distribution manifolds shall be installed only after the installation of all other utilities has been completed, and immediately prior to the soil-gas-retarder membrane. Pipes shall be installed with a row of perforations located at the bottom of the pipe, in order to allow condensate to drain from the system. Pipes shall be arranged in a pattern that provides at least two possible flow paths from any point in the system to a radon vent pipe. Separate sections of pipe shall be solvent welded or mechanically fastened together.

E403.3.2 Radon vent connection. The radon vent pipe shall join to the perforated pipe with a fitting that allows for the fill air-flow capacity of the vent pipe. The soil-gas-retarder membrane shall be fully sealed to the radon vents in accordance with the provisions of Section E302.

E403.4 Continuous gravel layer systems. Gravel used as the pressure distribution medium shall be installed only after the installation of all other utilities has been completed, and immediately prior to the soil-gas-retarder membrane. Where regions of gravel are isolated from one another by interior foundation elements, separate suction points shall be provided in each region, or regions shall be interconnected with pipes run horizontally through the obstruction. The size and number of such pipes shall be sufficient to provide at least two-times the anticipated air-flow. In no case shall fewer than two pipes be used to interconnect one gravel area with another. These pipes shall be separated by a horizontal distance not less than one-half the length of the boundary between the connecting gravel areas.

E403.4.1 Radon vent connection. The radon vent pipe shall join to the gravel layer with a "T" fitting that allows for the full airflow capacity of the vent pipe from either side of the "T." The fitting shall be installed with two arms in the gravel and a single arm connected to the radon vent pipe. The soil-gas-retarder membrane shall be fully scaled to the radon vents in accordance with the provisions of Section 302.

E403.5 Radon vent pipe installation. Radon vent pipes shall be solvent welded or otherwise joined to create a gas-tight connection from the soil-suction point to the vent termination point. They shall be sloped a minimum of $^1/_8$ inch (3 mm) per foot in a manner that will drain all rain and condensate back to the soil, and shall be supported in compliance with regulations for plumbing vents.

E403.5.1 Labeling. All portions of the radon vent pipe not permanently encased in a wall or chase shall be labeled to prevent accidental misuse. Labels shall consist of a pressure sensitive 2 inch (51 mm) yellow band with the words "RADON REDUCTION SYSTEM" printed in black letters at least 1 inch (25 mm) in height. These labels shall be placed on every visible portion of the vent pipe at a spacing of not more than 3 feet (914 mm). The labels shall be placed so as to be visible from any direction.

The size of vent pipes shall be determined by application of appropriate engineering principles, based on air-flow rates predicted with the large-building active soil-depressurization model. For systems that comply with the alternate compliance method, Section E403.2.2, and are installed in buildings with straight runs of vent pipes no more than 50 feet (15 240 mm) in height the required number and size of vent pipes may be determined as follows:

1. For up to 100 linear feet (30 480 mm) of ventilation mat use one 2-inch (51 mm) diameter pipe.
2. For up to 200 linear feet (60 960 mm) of ventilation mat use one 3-inch (76 mm) diameter pipe, or two 2-inch (76 mm) diameter pipes.
3. For up to 400 linear feet (121 920 mm) of ventilation mat use one 4-inch (102 mm) diameter pipe, or two 3-inch (76 mm) diameter pipes, or four 2-inch (30 480 mm) diameter pipes.

E403.5.2 Terminals. Radon vent pipes shall terminate with a rain cap, installed above the roof of the structure, and shall be located in accordance with existing codes for toxic or noxious exhausts. If not specifically addressed or applicable, vent pipes shall be terminated in locations that minimize human exposure to their exhaust air, such that the location is:

1. At least 12 inches (305 mm) above the surface of the roof;
2. At least 10 feet (3048 mm) from any window, door, or other opening (e.g., operable skylight or

air intake) to conditioned spaces of the structure; and

3. Ten feet (3048 mm) from any opening into an adjacent building.

The total required distance [10 feet (3048 mm)] shall be measured either directly between the two points or be the sum of measurements made around the intervening obstacles. If the discharge point is within two feet of elevation of the opening into conditioned space, the distance [10 feet (3048 mm)] shall be the horizontal distance between the points.

E403.6 Suction fans. Soil-depressurization system fans shall be designed to maintain the following minimum air-pressure differences at the lower opening of the radon vent pipe, as compared to the air pressure of the conditioned space above:

1. For systems using ventilation mats, 0.5 inch (.52 kPa) water column.
2. For systems using perforated pipe, 0.5 inch (.52 kPa)water column.
3. For systems using continuous gravel layers, 1.0 inch (.2488 kPa) water column.

E403.6.1 Fan sizing. Soil-depressurization systems that comply with the alternative compliance method, Section E403.2.2, and sizing, Section E403.5.2, may comply by sizing the fan as follows:

1. For up to 100 lineal feet (30 480 mm) of ventilation mat the fan shall be rated for 50 cfm (24 L/s) at 1-inch (30 480 mm) water column.
2. For 100 to 200 lineal feet (30 480 mm to 60 960 mm) of ventilation mat, the fan shall be rated for at least 100 cfm (30 480 mm) at 1-inch (30 480 mm) water column.
3. For 200 to 400 lineal feet (60 960 mm to 121 920 mm) of ventilation mat, the fan shall be rated for at least 175 cfm (83 L/S) at 1-inch (.2488 kPa) water column.

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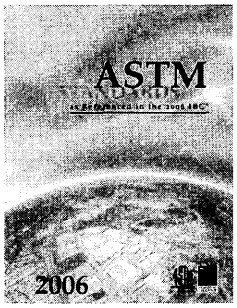

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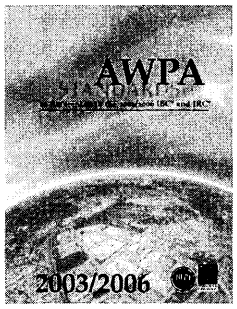

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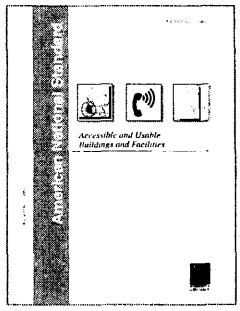

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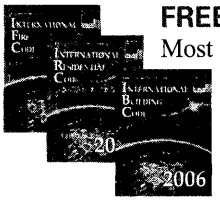

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